

The Polynesian Species of *Myoporum*¹

GRADY L. WEBSTER²

INTRODUCTION

THIS REVISION was originally begun as an analysis of the notoriously polymorphic species *Myoporum sandwicense* of the Hawaiian Islands. After a considerable amount of work had been done, however, it was found that the forms of *Myoporum* from southern Polynesia were very similar. Because of the closeness of relationship, it seemed both more practical and more worth while to treat all of the Polynesian species together.

In the Hawaiian Islands, *Myoporum sandwicense* is an evergreen shrub or tree which grows mostly in dry forests on leeward slopes from sea level to an altitude of 10,000 feet. Its plasticity in habit is remarkable, as it may become a tree 15 meters high in the dry forests (Rock, 1913: 427) or a creeping, fleshy, prostrate shrub on the beaches and low rocky islets. More rarely it may even invade the rain-forest, as in Waikolu Valley on Molokai.

The Hawaiians used the species, which they called *naio*, for timber in building houses (Brigham, 1908: 83). Apparently it was not cultivated, as it is in Rarotonga (Wilder, 1931: 100), for the perfume of the flowers. There are references (Bennett, 1832: 257; Hooker and Arnott, 1841: 93) concerning the attempts of traders of the 1820's to substitute *naio* wood for sandalwood in the Chinese

trade, but neither then nor since has the *naio* attained any real commercial value. Brown (1935: 279) reports that on the island of Rapa (in southern Polynesia) *naio* wood is used for building canoes and houses.

The real value of *Myoporum* to the Hawaiian Islands resides in its role in the formation of a dry forest cover and in the consequent checking of soil erosion. On most of the islands the dry forest region has been partially or completely denuded, with serious consequent erosion. Reforestation work has been carried out chiefly with quick-growing exotic trees such as *Casuarina* and *Eucalyptus*, but the appearance of the resulting vegetation is disappointing from an esthetic point of view. It is to be hoped that eventually the original dry forest trees, such as native species of *Diospyros*, *Acacia*, *Sophora*, and *Myoporum*, will regain a part of their lost dominance. Egler (1947: 425), studying the communities of the dry southeastern section of the Koolau Range on Oahu, predicted that although *Myoporum* was rare at that time it might in the future assume an important place in the *Prosopis* community.

Acknowledgments: Dr. Harold St. John of the University of Hawaii originally suggested this study, made it possible to collect and observe the plants in the field, and has been of great assistance in criticizing and offering suggestions for the manuscript. Mr. Otto Degener loaned his large and important collections for study and discussed with me some of the forms which I was unable to see in the field. Dr. B. C. Tharp readily consented to having the study continue at the University of Texas, and he and Dr. W. Gordon Whaley kindly

¹Part of a thesis submitted in partial fulfillment of requirements for the degree of Master of Arts in Botany at the University of Texas. Manuscript received September 22, 1949.

²Former graduate assistant in Botany, University of Hawaii, and Teaching Assistant in Biology, University of Texas; now at the Herbarium, University Museum, University of Michigan.

read and criticized the manuscript. I also wish to thank Miss Marie Neal for making available the facilities of the Bishop Museum Herbarium, Miss Mary Lou Jeffrey and Mr. William L. Brudon for drawing the illustrations, and the curators of the herbaria listed below for the loan of specimens:

Bishop Museum, Honolulu (BISH); Boissier Herbarium, Geneva (G-BOIS); Otto Degener, personal herbarium (DEG); Delessert Herbarium, Geneva (G-DEL); Gray Herbarium (GH); Royal Botanic Gardens, Kew (K); New York Botanical Garden (NY); Laboratoire de Phanerogamie, Paris (P); Riksmuseum, Stockholm (S); University of Texas, Austin (T); Naturhistorisches Museum, Vienna (W).

TAXONOMIC POSITION

The genus *Myoporum* consists of about 30 species scattered over a wide area including Mauritius, Australia, New Zealand, New Guinea, China, Japan, Micronesia, and Polynesia. It is characterized by its relatively actinomorphic corolla and its fleshy drupe with usually solitary ovules in the cells. Like other genera in the Myoporaceae, *Myoporum* has axillary flowers, stamens with confluent anther cells, pendent anatropous ovules, and gland-dotted, alternate leaves. The Verbenaceae is probably the most closely related family, but it is well distinguished by its ovules which are not apically attached and by its opposite leaves which lack internal secretory tissue (Solereder, 1899: 711).

The Polynesian species of *Myoporum* belong to section *Pentacoelium* of Gray (1866: 51), which has priority over the more appropriate name *Eumyoporum* of Bentham (1870: 2). Wettstein (1895: 360) distinguished three sections which contained Pacific insular species—*Pentacoelium*, *Polycoelium*, and *Eumyoporum*—but there is no justification for placing these insular species in more than one section. Kraenzlin's sections (1929: 15) are even more poorly founded, so it seems

that so far no really satisfactory subdivision of the genus has been made.

The Hawaiian species *M. sandwicense* was apparently first collected by Archibald Menzies on Vancouver's expedition and was at first referred to the New Caledonian *M. tenuifolium* by Hooker and Arnott (1841: 93). It was described as a new species, *Polycoelium sandwicense*, by De Candolle (1847: 705) and was redescribed in the genus *Myoporum* by Asa Gray (1866: 52). No other name was officially proposed for any of the Hawaiian plants until Lévêille (1912: 63) published *M. Fauriei* based on a Faurie specimen from the island of Hawaii. Kraenzlin (1929: 21) reduced the species to a variety but appears to have misapplied the name to specimens of var. *sandwicense*.

Hugh Cuming had collected *Myoporum* in the Austral Islands (Tubuai) in 1828, but over a hundred years went by before any new species were described from southern Polynesia. Cheeseman (1903: 291) listed as *Myoporum* sp. a Mangaian plant cultivated on Rarotonga. Wilder (1931: 100) referred the Rarotongan plant to *M. sandwicense*, but Skottsberg (1933: 165) described it as a new species—*M. Wilderi*—and discussed its probable relationships to most of the other insular species. Two years later Brown (1935: 277) published three species from the Austral Islands and Rapa.

Variation in the Hawaiian myoporums has been discussed by Skottsberg in his paper on *M. Wilderi* and by Degener (1930: 261), but neither has published any new names although Degener illustrated a pubescent-leaved form and announced his intention of describing it in his *Flora Hawaiiensis*.

MORPHOLOGICAL CRITERIA

Because of the extreme polymorphism of many Hawaiian populations of *Myoporum* it is difficult to find morphological characters which do not vary as much between individuals as between varieties. An accurate concept of the range of variation—arrived at

by observation of a great many specimens—is essential in defining the taxonomic characters of the various groups.

Growth habit, as has been indicated, is so greatly modified by environment that it is probably of no taxonomic significance. The stem is significant only in distinguishing var. *stellatum* from var. *Degeneri*, the former having pubescent branchlets.

There are many leaf shapes but few of them are constant in any one population. Serrate margins are found sporadically among nearly all the Hawaiian varieties and must be used with extreme caution as a taxonomic character. On the other hand, this serrature is constant in the southern Polynesian forms and may be used dependably to separate *M. Stokesii* from *M. rapense*. Conspicuous differences in leaf texture occur among the Hawaiian plants, but in the main these appear to reflect environmental differences. The relative conspicuousness of the nervation depends in turn on leaf texture and is thus obviously unreliable.

The leaves of all the Polynesian species have subepidermal pellucid-punctate tissue, and the distribution and type of these pellucid spots appear to be good specific criteria. *M. Stokesii* and *M. rapense* are difficult to separate from the New Zealand *M. laetum* except for the fact that the glandular spots on the leaves of the latter are far more conspicuous. In *M. laetum* the pellucid spots are visible by reflected light (on the upper leaf surface) and give a distinct "polka dot" effect in transmitted light. The spots of the two Polynesian species are smaller, less conspicuous in transmitted light, and almost invisible in reflected light.

A readily recognizable and often valuable leaf character in Hawaiian *Myoporum* is the presence of pubescence. Unfortunately, while pubescent leaves are constant features of varieties *stellatum* and *Degeneri* they may appear sporadically in populations of other varieties which ordinarily have glabrous leaves. These sporadic occurrences seem

often to be a response to wounding caused by grazing animals, although in some cases the lower "sucker" shoots from an uninjured plant may bear pubescent leaves. In fact, even if the leaves on basal or wound shoots are not pubescent, they are often serrate and larger than normal leaves. Furthermore, there is evidence that at least in some groups of *Myoporum sandwicense* the "juvenile" leaves of a young plant are of the abnormal serrate-pubescent type, while those formed later are entire and glabrous. Further investigations on this subject are much to be desired.

The number of flowers in the axillary clusters varies not only between plants but even on the same branch and thus does not appear to be of any great taxonomic value. The same can be said of the flower pedicels, which vary widely, but inconsistently, in length and thickness.

The number and length of the calyx lobes, within certain ranges of variation, are significant, while their shape (on account of its plasticity) is usually less so. The size and shape of the corolla have not been used for distinguishing varieties; although there are readily apparent differences, they are overlapping and inconstant. The amount of pubescence on the corolla throat is usually quite variable and may or may not have significance.

The ovary is generally uniform in shape and constant in size, within any one variety. It is glabrous and has a somewhat expanded, differently colored basal region which seems to be nectariferous. At anthesis the flowers may be noticeably fragrant, although I have personally found the flowers of *M. sandwicense* to be almost odorless. In marked contrast to the Hawaiian species in this regard are *M. Stokesii* and *M. rapense*, whose flowers are credited in collectors' notes as ranging in scent from "strong sweet" to "fetid."

The style furnishes some of the best taxonomic criteria, especially in its length and in the presence or absence of pubescence.

This last character is undoubtedly valuable in delimiting species, although it may occasionally be inconstant (on the islands of Hawaii and Raivavae). The abrupt basal curvature of the style observed in some of the specimens from southern Polynesia is an inconstant character and its importance is hard to assess on the basis of the small amount of material studied.

The number of stamens is one of the classical key characters for separating *M. sandwicense* from the other Polynesian species, but this distinction breaks down when a large number of Hawaiian specimens is examined. The length and height of insertion of the stamens were found to be quite inconstant, and the degree of divergence of the anther cells is dependent on age and is of no taxonomic value at all.

The drupes of most of the Hawaiian varieties differ from the other Polynesian species in having a greenish-white exocarp. Some plants on the island of Hawaii (var. *Fauriei*), however, may have either whitish, pink, or purplish drupes. The drupes of *M. Stokesii* and *M. rapense* are pink or red and brick-red or purplish-red, respectively, while those of *M. laetum* are said to be purple. Judging from the variability of color in *M. sandwicense* var. *Fauriei*, however, it would be unwise to consider differences in shade of color as especially meaningful. The presence of color in the drupes of var. *Fauriei* and its absence in the other Hawaiian varieties do seem to be significant, however.

The bony endocarp is usually subglobose or top-shaped and often ridged at the top or along the sides. Its shape, although extremely variable, is a distinguishing character in some varieties and species. The number of cells in the drupe is inconstant, but a knowledge of the range of variation will assist in placing a specimen in the proper category. Counting the number of cells is not always easy as some of the abortive ones may be quite small. There is often a considerable degree of sterility, for many drupes will be found to

contain only one or two cells with well-developed seeds.

TAXONOMIC CATEGORIES

The *species* is here considered to be a population whose individuals have in common an ensemble of fundamental morphological characters different from that present in other species. It is reasonable to suppose that this morphological distinctiveness is due to various types of barriers (such as geographical, physiological, and genetical) which prevent a free genetic exchange with other species.

The categories *subspecies* and *variety*, as here used, apply to groups which occupy a discrete region within the total area of the species and which are characterized by a lack of sharp morphological distinctness from other groups within the species. A subspecies differs from a variety in its greater morphological differentiation, but does not necessarily occupy a greater area. Both are considered to lack genetic isolation—that is, varieties of the same species would be expected to interbreed freely when brought together—and no doubt often owe their existence to geographical barriers.

In recent years there has been considerable discussion among taxonomists as to whether the geographically delimited groups within a species should be given the rank of subspecies or of variety. However, in this work it has seemed better to use both categories in order better to accommodate the great sub-specific range of differentiation.

The *form*, in the present interpretation, is a group of plants which occur within a variety and differ by very minor or inconstant characters; they may or may not be geographically localized. Specimens may also be referred to forms when they are inadequate to give an accurate concept of the population. Inasmuch as the forms listed in this study are not conveniently separated morphologically and to some extent are designations based on incomplete knowledge, it seems unwise to

dignify them with Latin names. For convenience they are listed by number, each under the island where it occurs.

DISTRIBUTION

So far species of *Myoporum* have not been discovered on any of the islands occurring in the 3,000-mile expanse of sea between Hawaii and the Austral Islands. It is not surprising that they are missing from low coral atolls such as Palmyra and Fanning, but their absence from the Society Islands, the Marquesas, and Makatea is unexpected, as is their absence from other large Pacific islands such as Samoa and Fiji.

The disjunct distribution of *M. sandwicense*—with two subspecies in the Hawaiian Islands and one in the Cook Islands (Mangaia)—is not unique, however. For instance, *Isachne distichophylla* has been found only on Rarotonga and in the Hawaiian Islands. *Hedyotis* section *Bikkiocarpa* has two species, one from West Maui and one from Rapa (see Fosberg, 1943: 25). The genus *Phyllostegia* has 23 species in the Hawaiian Islands and one in Tahiti. Our present state of knowledge is insufficient to explain these facts of distribution. However, the theory of Zimmerman (1948: 49–52) that high volcanic islands, now reduced to reefs or atolls by erosion, once existed as stepping-stones in the mid-Pacific indicates how these cases of bicentric distribution might have arisen.

At the time of Captain Cook's visit *Myoporum* undoubtedly existed on all seven of the main Hawaiian Islands. It is now absent from the denuded island of Kahoolawe, but Forbes (1913: 86) learned from old visitors to the island that the *naio* had been seen there before the dry forest was wiped out. The relative abundance of the species at those localities where it still persists has no doubt undergone great changes. In some areas, as at Kaena Point on Oahu and the Puuwaawaa district of Hawaii, it may be as common as it was before the dry forests were disturbed; on the other hand it is rare or absent from

areas such as the Lualualei region on Oahu, western Molokai, and the Kohala peninsula of Hawaii, where probably it was once very abundant.

In the Austral Islands the destruction of the native forests has been so complete that a clear picture of the distribution of *Myoporum* there may never be obtained. St. John tells me that he made a special effort to collect *Myoporum* on these islands during the Mangarevan Expedition of 1934 and that few plants of the genus could have been overlooked in the vestiges of the native forest. Judging from his findings, *M. rapense* var. *Skottsbergii* and the form described by Brown as *M. rimatarense* may well be extinct.

On the basis of our present knowledge, however, it seems significant that *M. rapense* is found on the three lower islands of the Austral group and that its derivative *M. Stokesii* is restricted to Raivavae.

One of the chief difficulties in understanding the distributional pattern of Polynesian *Myoporum* is that the means of long-range dispersal of the genus are still a matter of conjecture. It does not appear likely that the fruits are spread by ocean currents, since my own observations show that they will float for no more than a few days. Dispersal by birds is a possibility, since some endemic Hawaiian birds were known to have eaten the seeds; but there is no evidence that any migratory birds are fond of the fruits. It must be admitted that the dispersal mechanism of *Myoporum* still remains unknown, and that the accidental transport by hurricanes is as likely a possibility as any.

RELATIONSHIPS OF THE SPECIES

At present, and in spite of a fairly recent monograph (Kraenzlin, 1929), the genus *Myoporum* is in great need of critical revision. The seat of the greatest systematic difficulty is the complex of chiefly insular species which includes the three Polynesian species. Almost nowhere within this insular complex are the species well defined, and it is very difficult to

find morphological characters sufficiently constant to distinguish them.

Because of its great range of morphological variation, *M. sandwicense* poses a particularly difficult problem in species definition. In its most typical form the species is well characterized by its flowers with five stamens and a glabrous style, and by its whitish-colored drupes with five or more cells. To some extent, however, every one of these characters proves to be inconstant when the complete range of variation of the species is ascertained. The other Polynesian species typically differ in having flowers with four stamens and pubescent styles as well as reddish-tinted drupes with fewer cells, but most of these characters are inconstant. However, *M. sandwicense* not only approaches the other Polynesian species very closely, but also is hard to separate from *M. tenuifolium*, a species lying to the west and southwest in Micronesia and Melanesia. This latter species is characterized by the small size of its flowers and fruits; but there are forms of *M. sandwicense* whose reproductive organs are of about the same dimensions. Of course, in all these cases species distinctions can be maintained by using rather complicated combinations of characters; for instance, *M. tenuifolium* can be separated from *M. sandwicense* by the fact that the forms of the latter which have small flowers and fruit do not have pink-tinted drupes. Such contrived species differences are admittedly unsatisfactory, but they will have to serve for the present. The temptation to combine various of the insular species should be resisted until the entire group is surveyed, because only then will it be possible to define the exact limits of *M. sandwicense* and its nearest congeners.

Because the classification of the insular myoporums is still in a very imperfect state, one hesitates to speculate as to the phylogeny of the Polynesian groups. However, the following observations on the possible relationships of the Hawaiian groups seem worthy of statement.

It is pretty clear that the group of *M. sandwicense* showing the greatest resemblance to the Austral Island species is ssp. *Wilderi*, although it is not possible to say whether or not the latter originated directly from or coordinately with the Austral Island species. Among the groups of *M. sandwicense* from the Hawaiian Islands proper, var. *Fauriei* shows the greatest resemblance to ssp. *Wilderi*. Because var. *Fauriei* is restricted to the island of Hawaii, it seems likely that this island was the point of immigration of *Myoporum*. Degener (1930: 266), on the basis of the occurrence of pubescent, serrate leaves on certain wounded plants from Molokai, has suggested that the direct ancestor of the Hawaiian forms had leaves of this type. However, this phenomenon does not seem to be a case of a reversion to an immediate ancestral type, but rather the expression of a potentiality which is widespread, inasmuch as independent occurrences of pubescent leaves are known from other Hawaiian islands as well as from Australia, New Zealand, and New Caledonia.

It seems evident that var. *sandwicense*, the most widely distributed of the Hawaiian groups, is derived from var. *Fauriei*, while it in turn has given rise to varieties *lanaiense*, *Degeneri*, and *stellatum*. The origin of ssp. *St.-Johnii* is more obscure. It could have come directly from the adjacent population of var. *Fauriei*, but the rather great morphological differences between the two entities make this rather questionable. The history of *Myoporum* on the island of Hawaii is made even more mysterious by the fact that var. *sandwicense* is absent from this island, even though it is presumed to have originated there. This suggests that the original population of var. *sandwicense* on Hawaii has become gradually modified into the group now known as ssp. *St.-Johnii*. This suggestion is of course hypothetical, but it would explain the curious anomaly of the absence of var. *sandwicense* from its presumed place of origin, as well as the occurrence on Hawaii of forms

of ssp. *St.-Johnii* very similar to var. *sandwicense*.

On each island of the Hawaiian group independent modifications, some of which are superficially similar and have resulted in a sort of parallel evolution, have arisen in the populations. This curious phenomenon, which is characteristic of populations on some other Pacific islands as well, has been remarked on by Degener (1930: 266), who realized the independent origins of the hairy-leaved and "peach-leaved" forms on the various Hawaiian islands. Even more perplexing from the taxonomic point of view is the occurrence of reversions of characters. Thus, in tracing the character of style pubescence in the Polynesian species, we find that it is present in *M. rapense*, beginning to disappear in *M. Stokesii*, absent in ssp. *Wilderi*, but reappearing in ssp. *St.-Johnii*. Naturally this sort of behavior of morphological characters introduces great hazards in classifying and interpreting the phylogeny of the Polynesian species.

It is interesting that there seems to be little evidence of inter-varietal hybridization in the Hawaiian Islands. No indubitably hybrid specimens have been seen except possibly from the island of Hawaii, and here additional field work will be necessary to establish the actual hybrid nature of such specimens. The conclusion seems inevitable that evolution in Hawaiian *Myoporum* has been most strongly conditioned by geographical isolation, while inter-varietal hybridization has not played an important part. The fast rate of differentiation and slow dispersal rate of the populations have been acting together to produce an intense micro-evolution. The taxonomic difficulty of characterizing *M. sandwicense* is a reflection of the rapidity and recentness of this process. Within this one species can be found groups at all stages of differentiation—from individual variants to populations of almost specific distinctness.

Owing to the ruination of much of the

flora of the Austral Islands, our knowledge of the groups there is rather incomplete. Nevertheless, it is clear that *M. rapense* is very closely related to *M. laetum* of New Zealand and is no doubt derived from it or a similar type. On Rapa and Tubuai it has changed little from the original immigrant, but on Raivavae it has given rise to and been almost supplanted by the polymorphic *M. Stokesii*, which itself is undergoing incipient speciation in the manner of *M. sandwicense*.

SYSTEMATIC TREATMENT

It is not pretended that the taxonomic arrangement which follows is definitive. Further collecting on some of the Hawaiian Islands may necessitate a reappraisal of some of the unnamed forms listed herein and should result in the discovery of additional forms and perhaps even new varieties. Adequate understanding of a highly polymorphic genus such as *Myoporum* requires accurate field observations, and careful notes by collectors concerning flower color and scent, fruit color, and leaf variation will be of great assistance in future studies.

MYOPORUM Soland. ex Forst. f., Prodr. 44. 1786.

Generic synonyms pertinent to the Polynesian species are:

Pentacoelium Sieb. & Zucc., Abh. Akad. Muench. 4(3): 151. 1846.

Polycoelium A. DC., Prodr. 11: 705. 1847.

Prinastrum Nutt. ex Gray, Am. Acad. Sci. 6: 53. 1866 (as synonym).

Low or erect shrubs, rarely tall trees. Leaves alternate (rarely opposite), sessile or with a winged petiole, linear to lanceolate or elliptic, entire or serrate, glabrous or rarely pubescent, often viscid when young. Flowers axillary, solitary or clustered, ebracteolate-pedicellate; calyx usually deeply 5-lobed, green and herbaceous, gland-dotted. Corolla usually 5-lobed, imbricate in the bud, sub-actinomorphic, campanulate to funnelform,

glabrous without, glabrous or pubescent within, usually glandular-punctate. Stamens usually 4, rarely more, alternate with the corolla lobes; filaments subulate or terete, glabrous or pubescent, adnate to the corolla; anther sacs confluent. Ovary of various shapes, often conic-cylindric, usually 2-5-celled (rarely the cells more numerous); style simple, usually as long as or longer than the ovary; stigma convex, entire or obscurely 2-5-grooved (rarely bifid); ovules solitary or rarely paired in each cell of the ovary, anatropous, pendent from the apex of the cell. Fruit a fleshy drupe; endocarp bony, usually more or less subglobose but sometimes depressed or laterally compressed; seeds spindle-shaped, with scanty endosperm, the radicle superior.

TYPE SPECIES: *Myoporum laetum* Forst. f., here chosen as lectotype for the genus. It should be noted that Forster attributed the authorship of the genus *Myoporum* to Solander alone, and not to Banks and Solander, as subsequent writers have incorrectly done.

Section PENTACOELIUM (Sieb. & Zucc.) A. Gray, Proc. Am. Acad. Sci. 6: 51-52. 1866.

Pentacoelium Sieb. & Zucc., Abh. Akad. Muench. 4(3): 151. 1846 (as a genus).

Polycoelium (A. DC.) A. Gray, *op. cit.* (as a section).

Eumyoporum Bentham, Flora Australiensis 5: 2. 1870 (as a section).

Insularia Kraenzlin, Fedde Repert. Sp. Nov., Beih. 54: 15-16. 1929 (as a section).

Ovary mostly 2-4-celled; ovule, one in each cell. Drupe mostly subglobose, not strongly laterally compressed.

KEY TO THE POLYNESIAN SPECIES

This key is intended for use in determining specimens in flower and fruit. Sterile twigs from the base of a plant or from a wounded branch may sometimes have serrate and/or densely pubescent leaves very unlike the normal ones. Specimens of this unusual type

should be accompanied by normal flowering branches if the correct determination is to be made.

- A. Style glabrous, or if hirsutulous then 2-3.5 mm. long and fruit not red-tinged. . . 1. *M. sandwicense*
- B. Style glabrous.
 - C. Stamens usually 5 (less commonly 4 or 6); corolla glabrous or pubescent; leaves various, not elliptic-spatulate and abruptly acute. 2. ssp. *sandwicense*
 - D. Leaves glabrous.
 - E. Endocarp strongly depressed, not or scarcely ridged, the thick wall exceeding the cells in diameter. . . 5. var. *lanaiense*
 - E. Endocarp of various shapes, often ridged, rarely strongly depressed, and then the wall thinner than the cells in diameter.
 - F. Calyx lobes mostly 1-3 mm. long; corolla often pubescent within; style mostly 1.5-3 mm. long; drupe always greenish-white; endocarp 2-6 mm. long, 4-10-celled. 3. var. *sandwicense*
 - F. Calyx lobes mostly 3-5 mm. long; corolla glabrous (or rarely sparsely pubescent) within; style mostly 3-5 mm. long; drupe sometimes pink or purplish; endocarp 5-10 mm. long, 4-6-celled. 4. var. *Fauriei*
 - D. Leaves pubescent.
 - G. Hairs branched; branchlets pubescent; leaves lanceolate or elliptic-lanceolate. 6. var. *stellatum*
 - G. Hairs unbranched.
 - H. Branchlets glabrous; leaves often broadly elliptic, entire or remotely serrate. 7. var. *Degeneri*
 - H. Branchlets usually pubescent; leaves lanceolate.
 - I. Corolla not over 6 mm. long; style less than 3 mm. long. var. *sandwicense*, pubescent form
 - I. Corolla over 6 mm. long; style 3 mm. long or more. var. *Fauriei*, pubescent form
- C. Stamens constantly 4; corolla densely pubescent; leaves elliptic-spatulate, abruptly acute. 9. ssp. *Wilderi*
- B. Style hirsutulous; flower parts mostly 6-8; endocarp usually 7-12-celled, often sharply ridged. 8. ssp. *St.-Johnii*
- A. Style hirsutulous (rarely glabrate in *M. Stokesii*), 4-6 mm. long; stamens 4; fruit pink or red; endocarp 3-6-celled.
 - J. Leaves entire; endocarp angled. . . 10. *M. Stokesii*
 - J. Leaves serrate; endocarp not or scarcely angled. 11. *M. rapense*
 - K. Calyx lobes not ciliate. 12. var. *rapense*
 - K. Calyx lobes ciliate. 13. var. *Skottsbergii*

1. *Myoporum sandwicense* A. Gray, Proc. Am. Acad. Sci. 6: 52-53. 1866.

Polycoelium sandwicense A. DC., Prodr. 11: 706. 1847 (illegitimate name).

Usually much-branched shrubs 1-3 m. high, but stature varying from prostrate (littoral form) to trees 15 m. tall. Stem usually glabrous with smooth green or olive-brown bark when young, gray and cracking into chunks when older. Leaves alternate, often lanceolate but varying from linear-lanceolate to ovate, acute to long-acuminate, entire or often crenate or serrate, decurrent-petiolate, 3.5-22 cm. long, 0.5-4 cm. wide; usually somewhat fleshy but varying from submembranous to stiff-coriaceous when dry; usually glabrous or more rarely pubescent. Flowers axillary, in clusters of 2-10, often 1 or more abortive; pedicels terete or flattened, 0.5-1.7 cm. long. Calyx lobes 4-9, mostly 5, 1-6 mm. long, broadly ovate to oblong or lanceolate, green and herbaceous or slightly scarious on the minutely glandular-denticulate margins, glandular-punctate, usually glabrous. Corolla 4-9- (mostly 5-) lobed, 4.5-12 mm. long, campanulate to funnelform, usually glandular-punctate, entirely glabrous to densely pubescent within; color pure white, white with pink-purplish splotches, or entirely pink; corolla lobes ovate-deltoid to oblong, emarginate, obtuse, or apiculate, 2-7 mm. long. Stamens inserted on the corolla, the same number as and alternate with the corolla lobes or occasionally 1 or 2 fewer; filaments flattened-subulate, 1.5-5 mm. long; anthers 0.5-1.5 mm. long, the cells confluent by a common suture and thus changing from parallel to widely divergent at anthesis. Ovary cylindric-conic to depressed-conic, 1.5-4 mm. long, glabrous, green, 4-12-celled, the base with a yellow or purple apparently nectariferous ring; style terete or flattened, 1.5-6 mm. long; stigma convex, obscurely 2-5-grooved. Drupe fleshy, the exocarp greenish-white or creamy-white, rarely pinkish or purplish; endocarp 2-10

mm. long, 2-9 mm. broad, smooth or ribbed, subglobose or variously flattened, hard and bony when mature. Seeds one in each cell, spindle-shaped, papery when dry, 2-2.5 mm. long.

The name *Myoporum sandwicense* dates from its use by Asa Gray in 1866, the original combination *Polycoelium sandwicense* A. DC. being illegitimate under the International Rules of Botanical Nomenclature, Article 60 (1). The generic name *Polycoelium* was a substitution for the earlier *Pentacoelium* of Siebold and Zuccarini, and hence was superfluous when published. According to Article 69 of the rules, Gray's adoption of the epithet *sandwicense* is treated as a new name and not as a new combination.

As here construed *M. sandwicense* embraces three rather diverse subspecies, each of which could well be treated as a species if their differences were constant. I have been reluctant to reduce *M. Wilderi* to a subspecies, but if this were not done consistency would demand the elevation of ssp. *St.-Johnii* to specific rank, and this action does not seem warranted.

2. *Myoporum sandwicense* ssp. *sandwicense*.

Myoporum sandwicense A. Gray, Proc. Am. Acad. Sci. 6: 52-53. 1866 (in part, excluding reference to *Douglas* collection).

Prostrate shrubs to tall trees. Leaves mostly lanceolate, less commonly almost linear or ovate or elliptic, never spatulate, 3.5-22 cm. long, 0.5-4 cm. broad, glabrous or pubescent. Flowers in clusters of 2-10 (mostly 3-5). Calyx mostly 5-lobed, lobes broadly ovate to oblong or lanceolate, 1-5 mm. long. Corolla mostly 5-lobed, glandular-punctate, glabrous or pubescent within, 4.5-12 mm. long. Stamens isomerous with the corolla lobes, the fifth one occasionally reduced or absent. Ovary 4-10-celled, 1.5-4 mm. long; style glabrous, 1.5-6 mm. long. Drupe creamy- or greenish-white or rarely pinkish or purplish;

endocarp 2–10 mm. long, 2–9 mm. broad, subglobose to depressed.

This extremely variable and complex subspecies is restricted to the Hawaiian Islands.

3. *Myoporum sandwicense* ssp. *sandwicense* var. *sandwicense*.

Pls. I, 2–6; II, 16–17, 27–30; III, 38–40

Myoporum sandwicense A. Gray, Proc. Am. Acad. Sci. 6: 52–53. 1866 (in part, excluding reference to *Douglas* and *Nuttall* collections).

Leaves mostly lanceolate to oblong or ovate lanceolate, rarely sublinear or ovate, 4–22 cm. long, 0.5–3.8 cm. broad, glabrous (except in one form). Flowers in clusters of 2–9 (mostly 3–6); pedicels 0.3–1.5 cm. long. Calyx mostly 5-lobed (rarely the lobes 4, 6, or 7); lobes broadly to narrowly ovate or oblong, 1–3 (rarely 4) mm. long. Corolla 5-lobed (rarely the lobes 6–7), glandular-punctate, glabrous or pubescent within, 4.5–8 (rarely to 9.5) mm. long. Stamens usually 5, occasionally one reduced (more rarely the number 4 or 6–8). Ovary 4–10-celled but mostly 5–7-celled; style 1.5–3 (rarely 4) mm. long. Drupe creamy-white, never pink or purplish; endocarp 2–6 (rarely 7) mm. long, mostly subglobose or top-shaped, usually ribbed.

LECTOTYPE: Isles Sandwich, Oahu, *Remy* 462 in the Gray Herbarium.

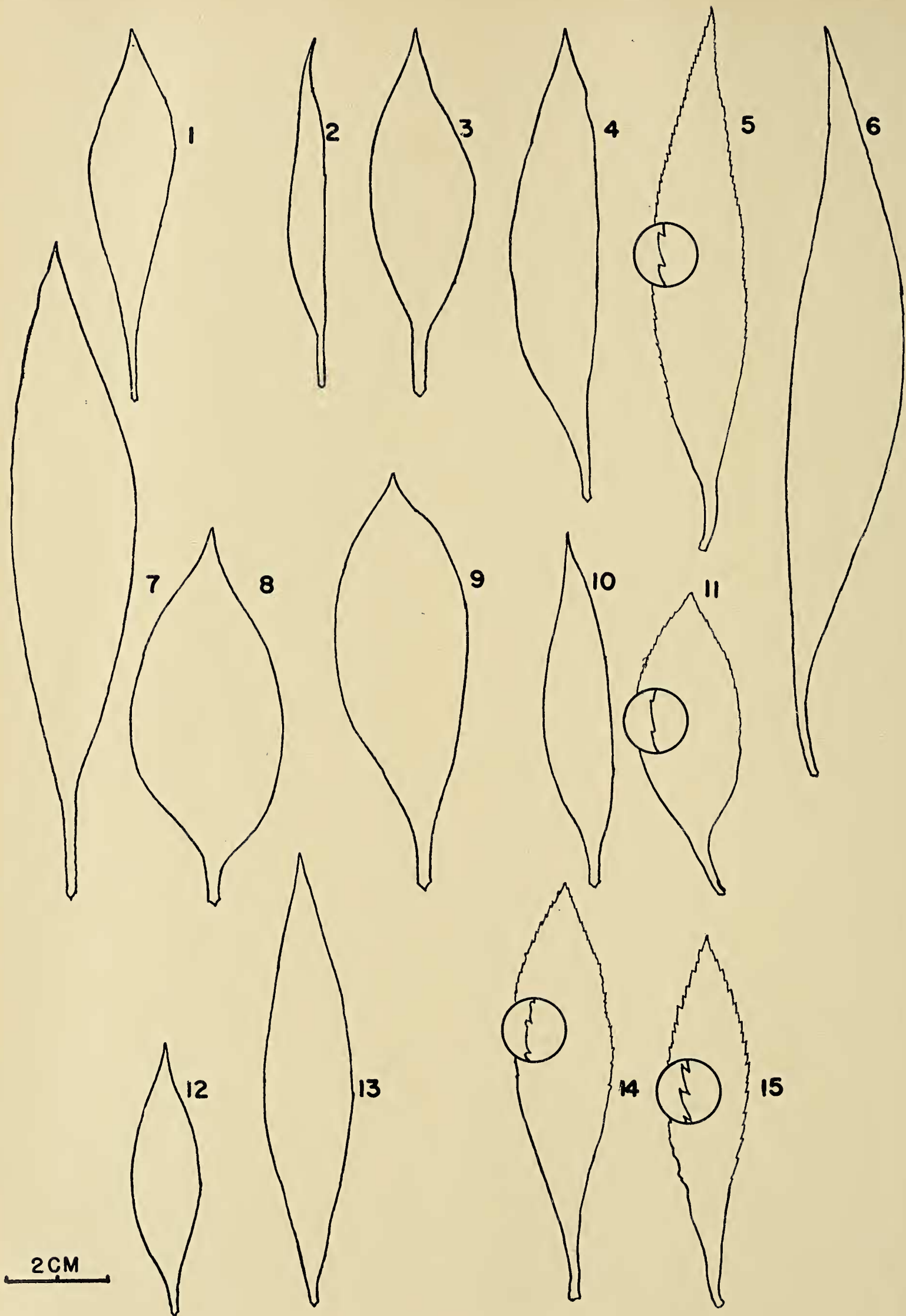
This extremely polymorphic variety is found at present on all the main islands except Hawaii and Kahoolawe. It is the heterogeneous residuum which remains after the more well-marked populations have been removed, and some of the forms enumerated here may warrant reappraisal when better known.

It has seemed best to arrange the various forms in a geographic sequence, first for the sake of convenience and also because forms from different islands which appear morphologically similar are most likely related not to each other but to adjacent forms on the same island. To give an idea of the correspondence and relationships of the forms,

however, the following key is submitted with the caution that a clear differentiation of the forms is not possible.

Key to forms of var. *sandwicense*

- A. Leaves all serrate, glabrous; style mostly 3–4 mm. long..... Molokai Form 3
- A. Leaves entire or occasionally serrate or pubescent and sharply serrate; style usually not over 3 mm. long.
 - B. Leaves glabrous.
 - C. Stamens 4; style mostly 2.5–4 mm. long..... Oahu Form 5, Kauai Form 4
 - C. Stamens mostly 5, rarely more.
 - D. Style 2.5–4 mm. long; corolla glabrous, broadly campanulate, the lobes 5–7..... East Maui Form
 - D. Style mostly 1–3 mm. long; corolla often pubescent, the lobes mostly 5.
 - E. Corolla lobes 6–8, corolla pubescent..... Oahu Form 4
 - E. Corolla lobes mostly 5, rarely 6.
 - F. Leaves large, 8–22 cm. long, often serrate; style 2–3 mm. long; corolla pubescent..... Kauai Form 1
 - F. Leaves smaller, 5–14 cm. long, mostly entire; corolla glabrous or pubescent.
 - G. Endocarp strongly depressed.
 - H. Calyx less than 2 mm. long..... Oahu Form 3
 - H. Calyx over 2 mm. long..... West Maui Form 2
 - G. Endocarp more or less isodiametric, or at least not depressed.
 - I. Leaves linear-lanceolate, 8–10 times as long as broad; calyx 2–3 mm. long..... Molokai Form 2
 - I. Leaves mostly less than 8 times as long as broad.
 - J. Leaves broadly elliptic.
 - K. Leaves rather membranous..... Kauai Form 3
 - K. Leaves fleshy, leathery when dry..... Oahu Form 1
 - J. Leaves mostly lanceolate.....
 - L. Leaves long-attenuate..... Kauai Form 4
 - L. Leaves acute to acuminate.
 - M. Cells of drupe 4–5; corolla mostly about 5 mm. long..... Molokai Form 1
 - M. Cells of drupe mostly 5–7, less commonly 8 or more, rarely 4; corolla often longer than 5 mm..... Niihau Form, Kauai Form 2, Oahu Form 2, Lanai Form, West Maui Form 1
 - B. Leaves mostly densely pubescent and serrate, sometimes glabrous entire leaves on the same plant..... Molokai Form 4



Specimens examined

HAWAIIAN ISLANDS (without specific locality):

Bennett (K); *Gaudichaud* 39 (G-DEL, P); 1839, *Gaudichaud* (G-DEL); *Macrae* (K); *Menzies* (K); *Wilkes Expedition* (NY); "Hawaii," *Wilkes Expedition* (NY).

NIIHAU:

At foot of plateau, South East, *Stokes* (BISH, NY); south corner of plateau, *Stokes* (BISH); Kalaalaau Valley, alt. 50 ft., *St. John* 22747 (BISH); Mokouia Valley, alt. 500 ft., *St. John* 23592 (BISH); Paniau, 1 mile S. of, crest of windward cliff, alt. 1,200 ft., *St. John* 23603 (BISH).

KAUAI:

Form 1. Leaves large, 8–22 cm. long, tending to be serrate. Stamens 5.

Waimea, seacoast, *Mann & Brigham* 585 (in part) (G-BOIS, GH, NY); Waimea, Polihale, flat back of beach, *St. John et al.* 22956, 22957, 22961 (BISH, T).

Form 2. Leaves mostly smaller and entire, 5.5–14 cm. long. Stamens 5.

Without locality, *Menzies* (GH); *Wawra* 2072, 2407 (W); Oct. 1916, *Rock* (BISH). Waimea, seacoast, *Mann & Brigham* 585 (in part) (BISH, GH); Napali Coast, at top of beach west of Kalalau Valley, *St. John et al.* 23208 (BISH, T); barren ridge, Waimea Drainage Basin, West Side, *Forbes* 982.K (BISH); Waimea, Milolii Ridge, on bare windswept headland, *St. John & Fosberg* 13711 (BISH); Waimea, Polihale, rocky lowland, alt. 30 ft., *St. John et al.* 22955 (BISH, T); Haeleele Valley, *Degener* 9736 (DEG); northwest side of Waimea Canyon, along ditch trail at 3,500 ft., *Degener* 20515

(DEG); Waimea, Kumuwela [Kumuweia] Ridge, bottom of gulch near stream, alt. 3,500 ft., *St. John, Fosberg, & Oliveira* 13852 (BISH); southeast side Kumuwela Ridge, moist open forest, alt. 1,100 m., *Fosberg* 12650 (BISH); Kaholuamanu, *Forbes* 319.K (BISH); same locality [Kaholuamano], *Rock?* 92 (BISH), *Rock* 2478 (BISH, GH, NY), 5258 (BISH), 5259 (GH).

Form 3. Leaves elliptic, rather abruptly contracted to the tip.

Without specific locality, *Remy* 463 (GH).

Form 4. Like *Form* 2 but stamens 4.

Without specific locality, *Wawra* 2299 (W).

Form 5. Leaves attenuate-acuminate, entire. Stamens 5. Drupe 6–7 mm. long.

Without locality, *Brodie* (BISH); ridge west of the Hanapepe River, *Heller* 2452 (BISH, G-BOIS, G-DEL, GH, NY, P).

OAHU:

Form 1. Leaves fleshy, elliptic, up to 3 cm. wide (probably a mere ecological form).

Without locality, *Remy* 461 (GH, P); Mokuleia, near sea, *Degener* 9730 (DEG, NY); Moku Manu I. (islet off Mokapu Point), *Munro* (BISH).

Form 2. Leaves lanceolate. Stamens 5 or rarely 4 or 6. Drupe subglobose, 5–8-celled (up to 10-celled in specimens from Koolau Range). Styles mostly 1.5–2.0 mm. long.

Without locality: *Beechey Expedition* (G-DEL, K), *Remy* 462 (GH), *Wilkes Expedition* (GH).

Waianae Range: Kaena Pt., *Bryan* (BISH); Kaena Pt., Kuaokala, *Cowan* 726 (BISH); Kaena, in front of beach, alt. 15 ft., *Cowan* 732, 737 (BISH); Kaena Pt., near sea,

PLATE I

Leaf outlines of the Polynesian species of *Myoporum*.

EXPLANATION OF PLATE

M. sandwicense var. *stellatum*: (1) from *Webster* 1243, Oahu. *M. sandwicense* var. *sandwicense*: (2) from *Forbes* 148.Mo, Molokai; (3) from *Degener* 9730, Oahu; (4) from *Fosberg* 13153, Oahu; (5) from *Degener* 12184, Molokai; (6) from *Heller* 2452, Kauai. *M. sandwicense* var. *Fauriei*: (7) from *Webster & Wilbur* 1775, Hawaii; (8) from *Rock* 8335, Hawaii. *M. sandwicense* ssp. *Wilderi*: (9) from *Wilder* 781, Rarotonga. *M. sandwicense* var. *Degeneri*: (10) and (11) from *Degener* 12183, East Maui. *M. Stokesii*: (12) from *St. John & Fosberg* 15956, Raivavae; (13) from *St. John & Fosberg* 15964, Raivavae. *M. rapense* var. *Skottsbergii*: (14) from *Cuming* 1430, Tubuai. *M. rapense* var. *rapense*: (15) from *Fosberg* 11525, Rapa.

HAWAIIAN ISLANDS ASSEMBLED

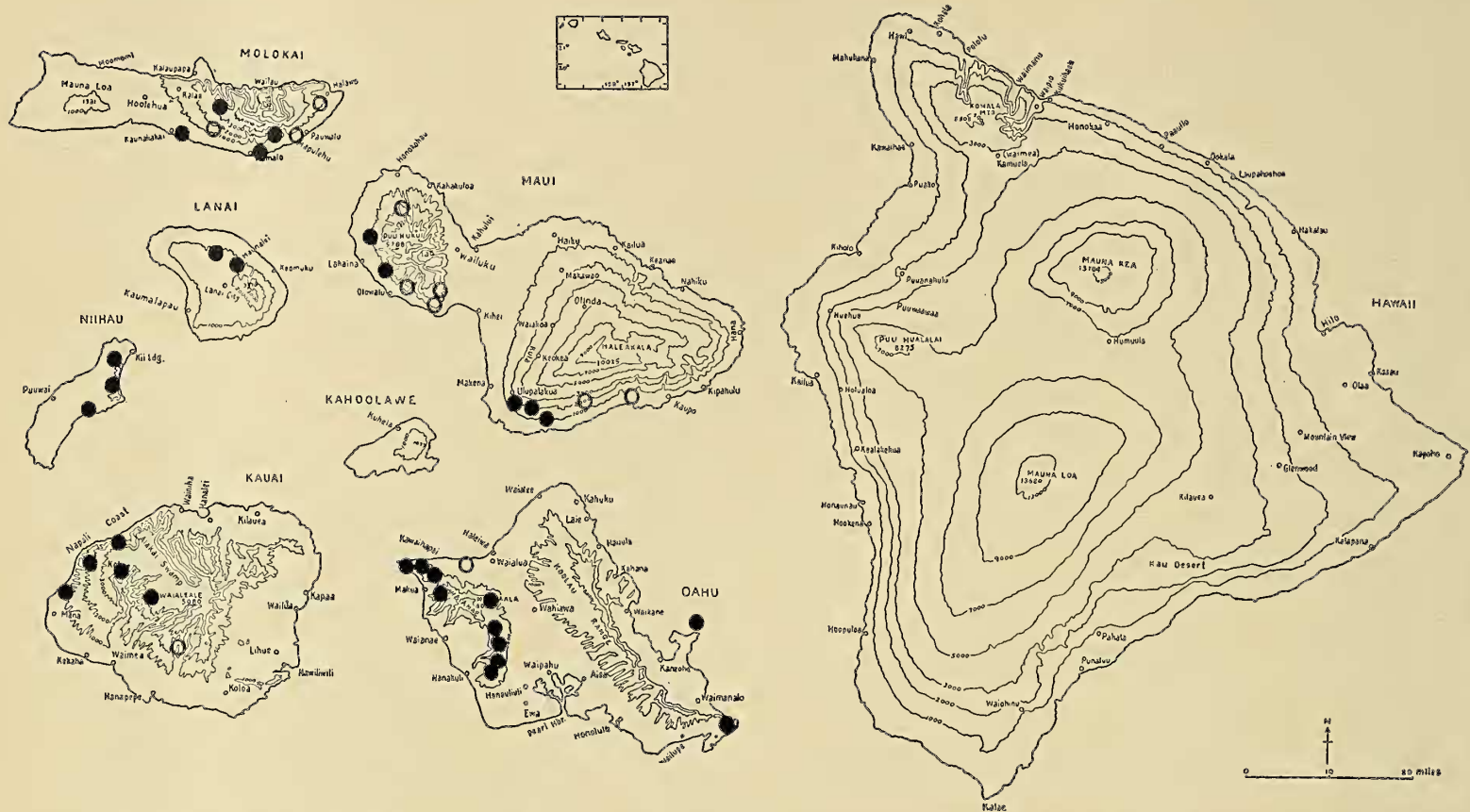


FIG. 1. Distribution of *M. sandwicense* var. *sandwicense*. Solid dots indicate exact locality, open dots approximate locality. (Base map, courtesy of Bernice P. Bishop Museum.)

Degener, Park, & Nitta 9731 (DEG); Kaena Pt., *Forbes* 1652.0 (BISH, NY); bluff above Kaena Pt., alt. 60 m., *Fosberg* 13153 (BISH); by railroad, Kaena Pt., alt. 15–20 ft., *Neal* (BISH); Kaena Pt., *Russ* (BISH), *Topping* (DEG); Nihoa Gulch, Mokuleia, alt. 150 ft., *Hume* 307 (BISH); same locality, alt. 400 ft., *Liu* (DEG); Nihoa Gulch, Kaena, base of cliffs, alt. 400–500 ft., *St. John* 11140 (BISH); near beach 1 mile east of Kaena Pt., *Webster* 1077, 1079, 1080 (BISH, T), 1078 (BISH); cliffs 2 miles east of Kaena Pt., alt. 250–350 ft., *Webster* 1086, 1091 (BISH, T), 1090 (BISH); at the top of the first gulch east of Kaena Pt., alt. 400 ft., *Webster* 1092.A (BISH, T), 1092.B (near to Form 3) (BISH); cliffs 1 mile east of Kaena Pt., alt. 400 ft., *Webster & Cowan* 1097 (BISH, T); near road 1 mile east of Kaena Pt., *Webster & Krauss* 1096 (BISH); Kewaula Valley, arid rocky valley, *Degener, Park, & Nitta* 9732 (DEG, NY); arid ravine near Kawaihapai, *Degener* 2197 (DEG, NY); steep brushy wall of gulch, south side Makua Valley, alt. 500 m.,

Fosberg 12350 (BISH); Mt. Kaala, forest at 2,500 ft., *Degener, Murashige, & Kerr* 19736 (transitional to Form 4) (DEG); Puu Kanehoa, southeast ridge of south peak, alt. 1,900 ft., *St. John* 23291 (BISH).

Koolau Range: Maunalua, Kealakipapa Valley, alt. 5 m., *Fosberg* 10919 (BISH, DEG); Maunalua, east bottom of Kalama Valley, alt. 15 m., *V. O. Fosberg* 93, 95 (BISH); Maunalua, head of Manuwaii Valley, alt. 180 m., *V. O. Fosberg* 85 (BISH); arid rocky region west of Makapuu Head, *Degener, Park, & Hirai* 9728 (DEG, G-DEL, NY); rocky lowland 1 mile southwest of Makapuu Point, alt. 10 ft., *Dunn* (BISH).

Form 3. Like Form 2 but drupe strongly depressed.

Waianae Range: cliffs 2 miles east of Kaena Pt., alt. 250–350 ft., *Webster* 1081 (BISH, T); Kawaihapai Valley, alt. 400 ft., *Suehiro* (BISH).

Form 4. Like Form 2 but flower parts 6–8. Waianae Range: Kawaihapai, arid rocky

region, *Degener, Park, & Topping* 9729 (DEG, NY).

Form 5. Stamens invariably 4. Style 2–3 mm. long.

Waianae Mountains, *Hillebrand* (K); Waianae Range, *Hillebrand* (K); Kealia Trail, *Selling* 3913 (transitional to *Form* 2) (S); same locality, steep brushy slope, alt. 300 m., *Fosberg* 12858 (BISH); Puu Kaala, Waianae-uka, alt. 650 m., *Fosberg* 12614 (BISH); same locality, alt. 2,000 ft., *St. John* 12930 (BISH), *Webster & St. John* 1501 (BISH, T); near Kolekole Pass, *Selling (Bog Survey)* 3914 (BISH, S); Popouwela, *Forbes* 1593 (BISH, NY); Puu Kanehoa, east ridge, alt. 1,700 ft., *St. John* 14065 (BISH); Lihue Gulch, east branch, *Forbes* 1688.0 (BISH); same locality, *Russ* (BISH); Pouilihale ridge, semi-moist brushy ridge, alt. 700 m., *Fosberg* 13782 (BISH); Palehua, Honouliuli, crest of ridge, alt. 2,000 ft., *St. John* 11162 (BISH); Palehua, alt. 650 m., *Skottsberg* 324 (S); near Mauna Kapu, *Degener* 9741 (DEG).

MOLOKAI:

Form 1. Leaves narrowly lanceolate, entire, glabrous; drupe 4–5-celled.

Kaunakakai, below government road, on beach, *Wilder* (BISH, NY); east fork of Kawela Valley, *Degener* 12181.B (DEG); Kamalo, alt. 1,000 m., *Faurie* 678 (BISH); Kamalo road, sea-level, *Rock* 12578 (BISH); beach at Kamalo, *Rock* 17137 (annotated by *Rock* with an unpublished varietal name) (BISH); Mapulo'u [Mapulehu], *Rock* 6153 (GH, NY); Pukoo, *Faurie* 679 (P); south slope of Halawa Valley, *Degener* 9737 (DEG, G-DEL, NY).

Form 2. Leaves linear-lanceolate, entire, glabrous; drupe 5–8-celled.

Slopes of Puu Kolekole, *Forbes* 148.Mo (BISH, NY, P).

Form 3. Leaves oblong-lanceolate, all serrate, glabrous; drupe 4–5-celled.

North slope of Puu Kaeko, *Degener* 9739 (DEG); above head of Waikolu Valley, rainy shrubby gully, *Degener* 12182, 12184

(DEG); Waikolu, steep valley wall below Puu Kaeko, wet woods, alt. 3,000 ft., *St. John et al.* 23431 (BISH); same locality, alt. 2,800 ft., *St. John et al.* 23466 (BISH); same locality, alt. 2,000 ft., *St. John et al.* 23441 (BISH); Manawai—Kahanui ridge, moist forest, alt. 600 m., *Fosberg* 13392 (BISH).

Form 4. Leaves serrate, densely pubescent, or glabrous and entire leaves on the same plant.

Puu Kolekole, *Forbes* 181.Mo (BISH); east fork of Kawela Valley, three distinct forms growing together on dry rocky slope, *Degener* 12181.A (serrate-pubescent), 12181.C (entire, pubescent), 12181.D (entire, glabrous) (DEG).

LANAI:

Without specific locality, *Forbes* (BISH); flats above head of Hawaiiianui Gulch, alt. 500 m., *Fosberg* 12523 (BISH); Maunalei Gulch, dry basalt talus, alt. 800 ft., *St. John, Eames, & Hosaka* 18812 (BISH); Limestone Point, *Munro* (BISH) (identification doubtful).

WEST MAUI:

Form 1. Leaves narrowly lanceolate; drupe subglobose or broadly ovoid.

Without definite locality, *Mann & Brigham* 387 (G-DEL, GH, NY); Lahainaluna, Aug. 1910, *Forbes* (BISH, NY); south ridge of Laniupoko Valley, alt. 1,000 ft., *St. John & Catto* 17705, 17706 (BISH); Olowalu Valley, *Forbes* 2325.M (BISH, NY); from Papawai Point toward Puu Anu through Manawainui Gulch, *Degener* 9742 (DEG, NY); Pohakea Gulch, arid windy slope, *Degener* 9743 (DEG, G-DEL, NY); Wailuku, gulch south of Waikapuu [Waikapu] Valley, *Skottsberg* 783 (BISH, S).

Form 2. Like *Form* 1 but drupe strongly depressed.

Honokahau [Honokohau] Drainage Basin, *Forbes* 477.M (BISH, NY, P).

EAST MAUI:

The single form is much like West Maui

Form 1 but the style is longer and the flower parts may be more than 5.

"Sandwich Islands," *Hillebrand* (probably from East Maui) (GH); East Maui, *Hillebrand* (K); Haleakala, *Hillebrand* (K); Kula, open rocky Kula land, alt. 1,000 ft., *Wilder* 282 (BISH); near Ulupalakua, *Degener* 9740 (DEG, G-DEL, NY); southwest slope of Haleakala, above Kanaio, *Alexander & Kellogg* 5353 (BISH); Hokukano, arid lava waste, *Degener & Clay* 19408 (DEG); Nakaaha, dryish lava waste, *Degener* 19306 (DEG); Nu'u, rough lava flow, *Forbes* 1910.M (BISH).

The forms of var. *sandwicense* range in value from those which are probably ecological modifications to those which approach varietal distinction. Oahu Form 5 was at first thought to be possibly a variety because of its flowers with only four stamens, but the specimen collected by St. John (number 23291) from the center of its range at Puu Kanehoa shows that the stamen character is not constant.

The most perplexing forms of var. *sandwicense* are those found on Molokai, and additional field work must be done before a final systematic arrangement of them can be made. Molokai Form 3 is on the borderline of varietal status, but it is being kept as a form at present because its best character—constantly and sharply serrate leaves—does not distinguish it from populations on other islands within which serrate leaves are not uncommon.

4. *Myoporum sandwicense* ssp. *sandwicense* var. *Fauriei* (Lévl.) Kraenzlin, Fedde Repert. Sp. Nov. Beih. 54: 21. 1929.

Pls. I, 7-8; II, 18-19, 31; III, 41.

Myoporum Fauriei Lévl., Fedde Repert. Sp. Nov. 11: 63. 1912.

Leaves ovate-lanceolate to ovate or elliptic, acute or acuminate, entire or serrate, 5-17 cm. long, 0.9-4 cm. broad, mostly coarse and brittle-coriaceous but often thinner, glabrous or rarely pubescent. Flowers 2-5 to an axil;

HAWAIIAN ISLANDS ASSEMBLED

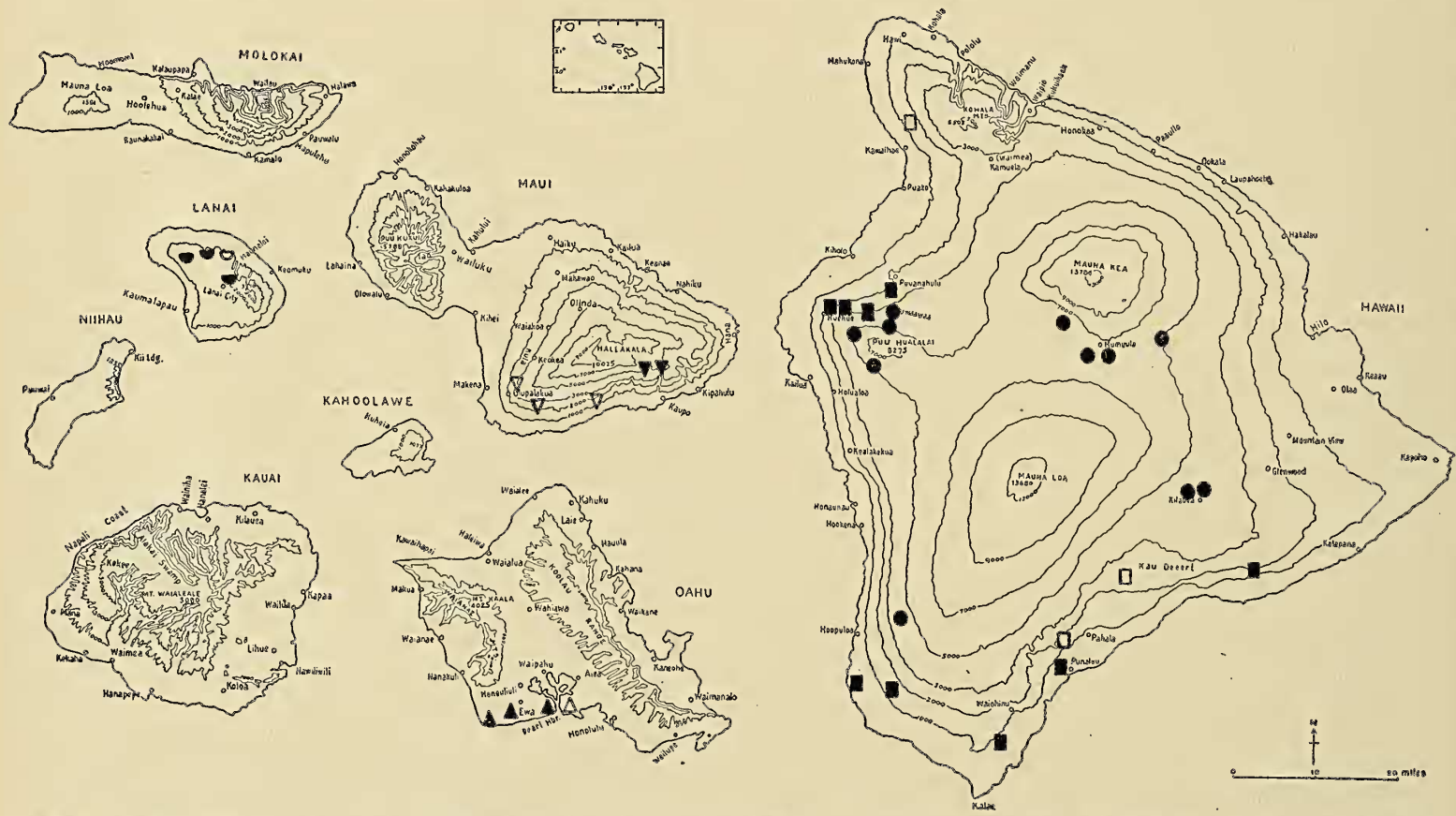


FIG. 2. Distribution of the other Hawaiian groups of *M. sandwicense*. Circles represent var. *Fauriei*, squares ssp. *St.-Johnii*, erect triangles var. *stellatum*, inverted triangles var. *Degeneri*, semicircles var. *lanaiense*. Solid symbols indicate exact locality, open symbols indicate approximate locality; specimens of really doubtful locality and those examined after the completion of this plate are not mapped. (Base map, courtesy of Bernice P. Bishop Museum.)

pedicels 0.5–1.7 cm. long. Calyx lobes 5 (rarely 6), 2.5–6 (mostly 3–5) mm. long, ovate-lanceolate to lanceolate. Corolla 5-lobed (rarely 6-lobed), 6.5–12 mm. long, glabrous or more rarely sparsely pubescent. Stamens mostly 5, rarely 6, often with one stamen reduced or sometimes entirely wanting. Ovary 2.5–4 mm. long, 4–6-celled (rarely 7-celled); style 2.5–6 (mostly 3–5) mm. long, glabrous. Drupe creamy-white or often pinkish or rarely purplish; endocarp broadly ovoid, 5–10 mm. long, not prominently ribbed.

TYPE: "Sandwich: Hawai, Maunakea, 2,000 m., juill. 1909 (Faurie, 677)." An isotype is in the Bishop Museum.

This variety is limited to the upper dry forest (altitude 4,000 feet to the timber line) on the island of Hawaii.³ It is conspicuous because of its large leaves, flowers, and fruit and seems a distinct entity in spite of its overlap of characters with var. *sandwicense*. Usually var. *Fauriei* has longer calyx lobes, styles, and drupes than var. *sandwicense*, but this does not always hold and then characters such as the number of cells in the drupe, the lack of corolla pubescence, and the general leaf aspect of var. *Fauriei* must be considered. Var. *Fauriei* appears to be the most primitive group of ssp. *sandwicense* and closely resembles ssp. *Wilderi* in flower size and drupe characters. Its retention of the pinkish drupe color and its flowers which often lack the fifth stamen are primitive characters of special significance. Within var. *Fauriei* one finds a great deal of polymorphism, there being large and small flowers, long elliptic-lanceolate and short ovate leaves; but I have not been able to segregate these types into populations.

Specimens examined

HAWAII:

Form 1. Leaves glabrous; flower parts in 5's; cells of drupe 4–6.

³Kraenzlin (1929: 21) erred in referring a collection from the New Hebrides (Herb. Boissier) to this variety. I have seen the material, and although it is too fragmentary to determine positively, there is no reason to believe that it represents *M. sandwicense*.

"Hawaiian Islands" (no definite island cited): *Collector unknown* (BISH); Bonite voyage, *Gaudichaud* (GH); *Hillebrand* (K); *Mann & Brigham* 568 (BISH).

Hawaii, without definite locality, *Challenger Expedition* (K), *Wilkes Expedition* (GH); South Hilo District, Waiakea, 22 miles up Saddle Road, alt. 5,100 ft., *St. John, Cowan, & Rogers* 22391 (BISH); North Hilo District, Humuula, Puu Huluhulu, alt. 6,750 ft., *Bryan* (BISH); same locality, alt. 6,760 ft., *St. John et al.* 23934, 23935 (glabrous sucker shoot from same plant as 23934), 23936 (pubescent sucker shoot from same plant) (BISH); Humuula, Saddle Road 1 mile south of Omaokoili, south slope of cinder cone, alt. 6,650 ft., *St. John, Cowan, & Rogers* 22379, 22380 (BISH); Pohakuloa, alt. 6,500 ft., *Bryan* (BISH); slopes of Mauna Kea above Waikii, *Rock* 8335 (BISH, GH); Puuwaawaa, *Austin* (BISH), *Munro* (BISH); Kona, above Huehue, *Rock* 3489 (BISH, GH); Hualalai, Puu Laalaau, alt. 6,300 ft., *Kondo* (BISH); Puu Hualalai, 4,100–6,500 ft. alt., *St. John et al.* 11394 (BISH); Kona, Captain Cook, south of Papaloa, alt. 5,000 ft., *Degener & Murashige* 20335 (DEG); Kealakekua, Greenwell Ranch, alt. 4,500 ft., *St. John & Hatheway* 23982 (BISH); South Kona District, Alika Homesteads, Koa Mill, alt. 4,500 ft., *St. John et al.* 22486 (BISH); Kilauea, *Forbes* ? (BISH), *Forbes, Brigham, & Thompson* (BISH, P); Hawaii National Park, Kipuka Ki, alt. 4,300 ft., *Webster & Wilbur* 1702, 1703, 1704, 1705, 1706, 1707 (BISH, T); Hawaii National Park, Bird Park [Kipuka Puaulu], alt. 4,000 ft., *Degener* 9735 (DEG, NY); same locality, *Bog Survey* 3254 (S), *Eastwood* (NY), *St. John et al.* 11260, 11266 (BISH), *Setchell* (S), *Skottsberg* 541 (BISH, S), *Webster & Wilbur* 1775, 1776, 1777 (BISH, T).

Form 2. Leaves pubescent; flower parts in 5's; cells of drupe 4–6.

North Hilo District, Humuula, Puu Huluhulu, open woods on cinder hill kipuka, alt. 6,570 ft., *St. John et al.* 23944 (BISH).

Form 3. Leaves pubescent; flower parts 6–7; cells of drupe 7–9.

Puuwaawaa, *Rock 3800* (BISH, NY). In several respects this form is intermediate between var. *Fauriei* and ssp. *St.-Johnii*.

5. *Myoporum sandwicense* ssp. *sandwicense* var. *lanaiense* Webster, var. nov.

Pls. II, 21, 33; III, 43

Drupa depressi-conica; endocarpium non costatum.

Leaves lanceolate, acuminate, entire, glabrous, 6–13.5 cm. long, 0.8–1.8 cm. wide. Flowers 2–4 per axil; pedicels 0.7–1 cm. long. Calyx lobes 5, 2–3 mm. long, ovate-acuminate. Corolla 5-lobed, 5–8 mm. long, glabrous or pubescent, the tube 2.5–4 mm. long. Ovary about 2 mm. long; style 1.8–3 mm. long. Drupe probably whitish in color; endocarp depressed-conic or hemispheric in outline, not or scarcely ridged, 3–4.5 mm. high, 6–9 mm. broad, 5–7-celled.)

TYPE: Mahana forehills, Lanai, July 1910, *Rock 8119*, in the Bishop Museum Herbarium. Isotypes are in the Gray Herbarium and Naturhistorisches Museum, Vienna.

This variety, named for the island on which it occurs, is apparently now restricted to the dry forest near Kanepuu at the northwest end of the island. Ordinarily it is easily distinguished from var. *sandwicense* by its strongly depressed endocarp. Rarely, plants of var. *sandwicense*, such as *Webster 1081* from Oahu and *Forbes 477.M* from Maui, may have depressed endocarps which appear superficially similar, but these are easily distinguished in cross section by their thinner walls (compare Figs. 39 and 43).

The status of var. *sandwicense* on Lanai is rather uncertain. Judging from the few collections at hand, it seems to occupy a lower altitudinal zone than var. *lanaiense*, but further collecting will be necessary before its distributional relationship to var. *lanaiense* will become clear.

Specimens examined

LANAI:

Koa dry forest, Lanai, *Munro 61* (BISH, NY); plateau on lee side of island, alt. 600 m. (?), *Wilder 90* (BISH); xerophytic forest near Kanepuu, *Fosberg 12551* (BISH); Kanepuu, Kaa, alt. 1,600 ft., *St. John, Eames, & Hosaka 18803* (BISH); same locality, alt. 1,700 ft., *St. John & Cowan 22624* (BISH); flats above head of Hawaiilanui Gulch, alt. 500 m., *Fosberg 12525* (BISH); Poomai [= Paoma?], *Munro* (BISH); Mahana Valley, *Munro 171½* (BISH); Mahana forehills, *Rock 8119* (BISH, GH, W); mountains near Koele, *Forbes 91.L* (BISH).

6. *Myoporum sandwicense* ssp. *sandwicense* var. *stellatum* Webster, var. nov.

Pls. I, 1; II, 20, 32; III, 42

Prinastrum cauliflorum Nutt. ex Gray, Am. Acad. Sci. 6: 52. 1866 (herbarium name published in synonymy).

Folia hirtella, ramuli hirtelli; pili ramosi.

Branchlets and leaves pubescent with branched hairs, somewhat glabrescent with age; leaves elliptic-lanceolate, usually entire, 4–9 cm. long, 0.7–2.2 cm. broad. Calyx mostly 5-lobed, pubescent, sepals 1.2–2.5 mm. long. Corolla 5-lobed (rarely 6-lobed), 5–7 mm. long, glabrous or pubescent within, the glandular dots rather inconspicuous. Stamens mostly 4 or 5, if 5 then often one reduced. Ovary 2–2.5 mm. long; style 2–2.8 mm. long. Drupe creamy-white; endocarp subglobose, ridged, 3–5 mm. in diameter, 5–7-celled.

TYPE: Oahu, Ewa coral plain near Barbers Point, alt. 10 ft., *Webster 1243*, in the Bishop Museum Herbarium (isotype in the University of Texas Herbarium).

This distinctive variety is now restricted to the low plain of emergent coral at the southwestern corner of Oahu. It is known from Kauai on the basis of a single collection by Nuttall, but has not been collected on that island in the century since then. If Nuttall's rather questionable locality was correct, the variety has evidently become extinct on

Kauai. On Oahu it originally grew from the mouth of Pearl Harbor to Barbers Point, but it has been exterminated over much of this range by the encroachment of military establishments. In the vicinity of the lighthouse it is still quite abundant, however, and will continue to persist unless the vegetation is entirely removed. Ecologically, it must be highly specialized, as it has become adapted to a calcareous substrate quite different from the lateritic or basaltic soils on which the other varieties grow.

Although this variety superficially resembles var. *Degeneri* in the pubescent leaves, it has been independently derived, probably from Oahu Form 5 of var. *sandwicense*. This relationship is especially evident in the fact that var. *stellatum* shows the tendency toward the loss of the fifth stamen which is fully expressed in the form from the Waianae Range.

The name of this variety alludes to the appearance of the branched hairs, a character unique in the genus as far as I can determine.

Specimens examined

KAUAI:

Atooi [=Kauai], *Nuttall* (K).

OAHU:

Honouliuli, Barbers Point coral plain, alt. 10 ft., *Cowan* 787, 788 (BISH); same locality, *Degener & Park* 9727 (DEG), *Egler* 37-268 (BISH), *Hosaka* 1359 (BISH), *Pollock* (F. Brown's) 1278 (BISH), *Rock* 17038 (BISH, labeled with an unpublished varietal name), *Setchell* (GH), *Webster* 1243, 1244, 1250 (BISH, T), 1245 (BISH), 1249 (T); between Barbers Point and Pearl Harbor, along beach, *Degener & Park* 9733 (DEG); Ewa, below Magnetic Observatory toward beach, *Egler & Hosaka* 37-419 (BISH); Puuloa, 1909, *Stokes* (BISH); east side of Pearl Harbor, *Stokes* (BISH).

7. *Myoporum sandwicense* ssp. *sandwicense* var. *Degeneri* Webster, var. nov.

Pl. I, 10-11

Folia elliptica hirtella serrata; pili simplici; ramuli glabri.

Branchlets glabrous. Leaves mostly elliptic, less commonly lanceolate, pubescent, the hairs unbranched, entire or serrate, 4-9 cm. long, 1-2.5 cm. broad. Flowers 5-6 per axil. Calyx lobes 5, glabrous or pubescent, 1.5-3.5 mm. long. Corolla glabrous or pubescent within, 5-7.5 mm. long. Stamens 5, rarely 4 or 6. Ovary 2-3.5 mm. long; style 2-5 mm. long. Drupe color unknown, presumably white; endocarp 5-9 mm. long, 5-7-celled.

TYPE: East Maui, north mauka of Ulupalakua, *Degener* 12183, in the Bishop Museum Herbarium.

This variety occurs on the dry leeward slopes of Haleakala, East Maui, from near Ulupalakua to the Kaupo Gap; a form from Molokai is referred here for convenience. It is named for Mr. Otto Degener, long a student of the Hawaiian *naio*, who illustrated it in his book, *Plants of Hawaii National Park*.

Specimens examined

MOLOKAI:

Probably near Kaluaaha, *Degener* 9738 (DEG, NY).

EAST MAUI:

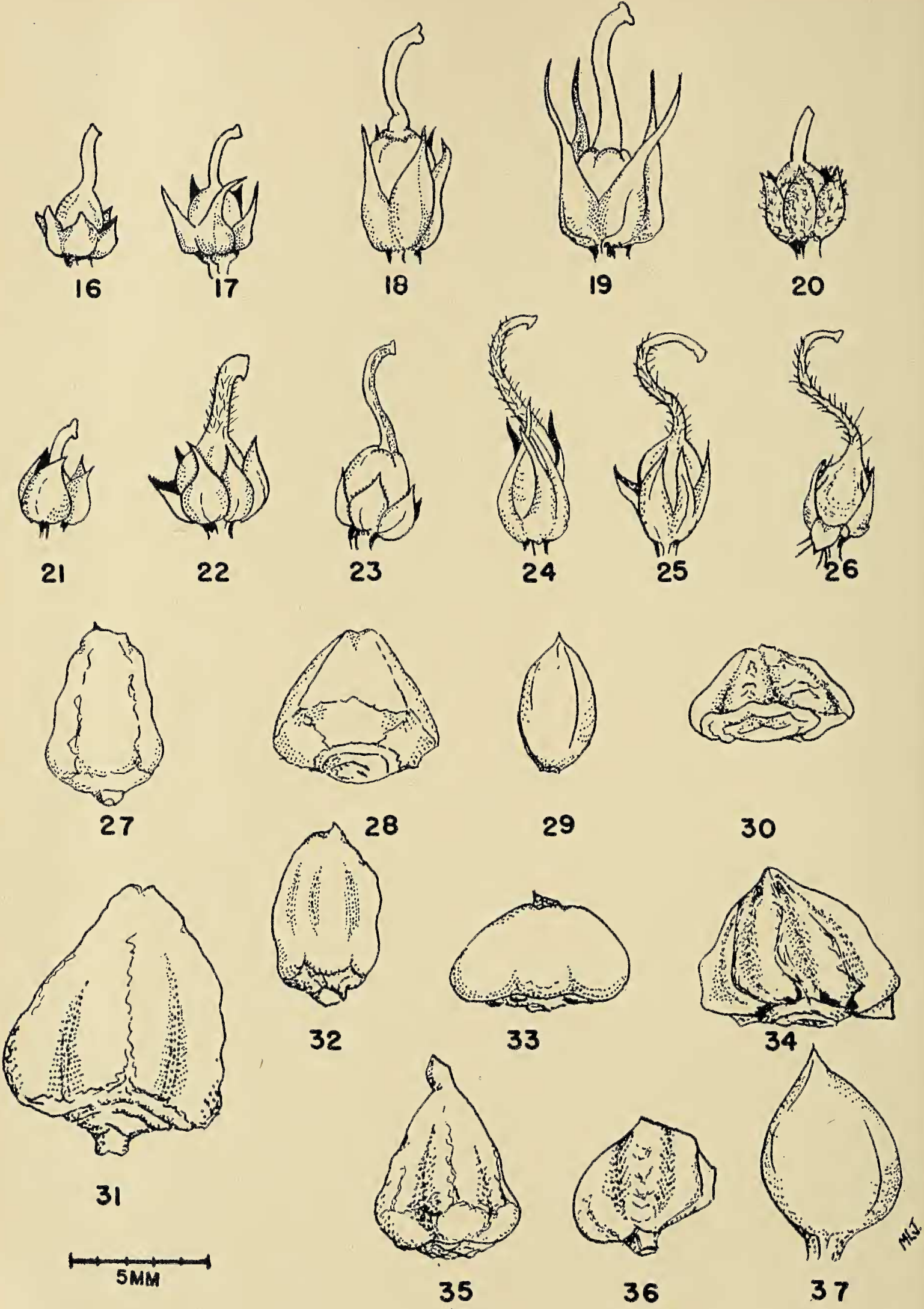
North mauka of Ulupalakua, *Degener* 12183 (BISH, DEG); Auhi [=Auwahi], Ulupalakua, *Munro* 385 (BISH); Kaapilopilo and Kapaehawai gulches, *Forbes* 1940.M (BISH); Waiopaa [=Waiopai] Ranch, *Forbes* 1875.M (BISH); Haleakala, Kaupo Gap, *Forbes* 1105.M (BISH); Haleakala, south of Kuiki along east side of Kaupo Gap, *Degener* 17600 (NY).

Although the plant from Molokai is placed in var. *Degeneri* for convenience, it probably has arisen independently of the Maui plants and may represent a different variety. However, until the confusing forms from Molokai are better understood, it seems unwise to describe any new varieties from there.

8. *Myoporum sandwicense* ssp. *St.-Johnii* Webster, ssp. nov.

Pls. II, 22, 34-35; III, 44

Petala et sepala plerumque 6-8; stylus hirtellus; drupa plerumque 7-12-locularis.



Shrubs to small trees, 2–8 m. high. Leaves mostly oblong-lanceolate, entire, glabrous, 4–15 cm. long, 0.5–3 cm. broad. Flowers 3–8 per axil; pedicels 0.6–1.2 cm. long. Flower parts varying from 5–9 but mostly 6–8, the sepals equal to or less than the number of corolla lobes. Sepals 1–3 mm. long. Corolla 5–8.5 mm. long, usually densely pubescent within, glandular spots absent or very few. Stamens usually 5–9 (very rarely less than 5), the same number as or less than the number of corolla lobes. Ovary 2–3 mm. long; style hirsutulous, 1.7–3.5 (mostly 2–3) mm. long. Drupe creamy-white; endocarp usually strongly ridged, more or less laterally compressed, 3–8 mm. long, 3.5–8 mm. broad, 5–13-celled but typically 7–12-celled.

TYPE: Hawaii, Kaupulehu, 2–3 miles east of Huehue, alt. 2,000 ft., *Webster & Wilbur* 1835, in the Bishop Museum Herbarium (isotype in the University of Texas Herbarium).

This polymorphic subspecies is restricted to the lower dry forests on the island of Hawaii. In its possession of a hirsutulous style it is unique among the groups within *M. sandwicense*, and it is further well marked by its large number of perianth parts, reduction of glandular spots on the corolla, and many-celled, sharply ribbed, endocarp. Morphologically, the typical form (Form 1) is fully as distinct from the other varieties of *M. sandwicense* as many species of this genus are from one another. But the typical form intergrades

with Form 2, which may be almost indistinguishable from some forms of var. *sandwicense*. This is especially true of specimens from the vicinity of Punaluu in the Kau District, but because they occur in the same area as plants of Form 1 and apparently are intermixed with them, it seems preferable to regard them as merely aberrant individuals of ssp. *St.-Johnii*, which for some reason (possibly they are remnants of an ancient population of var. *sandwicense* ?) are especially common in this vicinity.

This group is named for Dr. Harold St. John of the University of Hawaii, who suggested the study of *Myoporum* and whose assistance has greatly helped to overcome the disadvantages of completing this work at a distance from the Hawaiian Islands.

Specimens examined

HAWAIIAN ISLANDS (without specific locality):

Douglas 21 (K), *Douglas* (W).

HAWAII:

Form 1. Style hirsutulous and flower parts mostly 6–8. Cells of endocarp 7–13.

North Kona, *Alexander & Kellogg* 5367 (BISH); vicinity of Huehue near main road, *Bog Survey* 3213 (BISH, S); between Puuwaawaa and Huehue, *Degener* 2210 (DEG); Puuwaawaa, *Degener* 9726 (DEG, NY), *Nishina* (*Degener's*) 9744 (DEG, NY); 2.3 miles northeast of Huehue Ranch House, Kaupulehu, alt. 2,000 ft., *St. John et al.* 22525 (BISH);

PLATE II

Reproductive structures of the Polynesian species of *Myoporum*.

EXPLANATION OF PLATE

Mature pistils (FIGS. 16–26).

M. sandwicense var. *sandwicense*: (16) from *Webster* 1097, Oahu; (17) from *Heller* 2452, Kauai. *M. sandwicense* var. *Fauriei*: (18) from *Webster & Wilbur* 1706, Hawaii; (19) from *Webster & Wilbur* 1702, Hawaii. *M. sandwicense* var. *stellatum*: (20) from *Degener* 9727, Oahu. *M. sandwicense* var. *lanaiense*: (21) from *Rock* 8119, Lanai. *M. sandwicense* ssp. *St.-Johnii*: (22) from *Webster & Wilbur* 1835, Hawaii. *M. sandwicense* ssp. *Wilderi*: (23) from *Wilder* 781, Rarotonga. *M. Stokesii*: (24) from *St. John & Fosberg* 15947, Raivavae. *M. rapense* var. *rapense*: (25) from *St. John & Fosberg* 15280, Rapa. *M. rapense* var. *Skottsbergii*: (26) from *Cuming* 1430, Tubuai.

Side view of endocarps (FIGS. 27–37).

M. sandwicense var. *sandwicense*: (27) from *St. John et al.* 23208, Kauai; (28) from *Degener* 9729, Oahu; (29) from *Degener* 9737, Molokai; (30) from *Forbes* 477.M, West Maui. *M. sandwicense* var. *Fauriei*: (31) from *Webster & Wilbur* 1706, Hawaii. *M. sandwicense* var. *stellatum*: (32) from *Degener* 9727, Oahu. *M. sandwicense* var. *lanaiense*: (33) from *Rock* 8119, Lanai. *M. sandwicense* ssp. *St.-Johnii*: (34) from *Webster & Wilbur* 1835, Hawaii; (35) from *Degener* 2211, Hawaii. *M. Stokesii*: (36) from *Fosberg* 11784, Raivavae. *M. rapense* var. *rapense*: (37) from *St. John & Fosberg* 15280, Rapa.

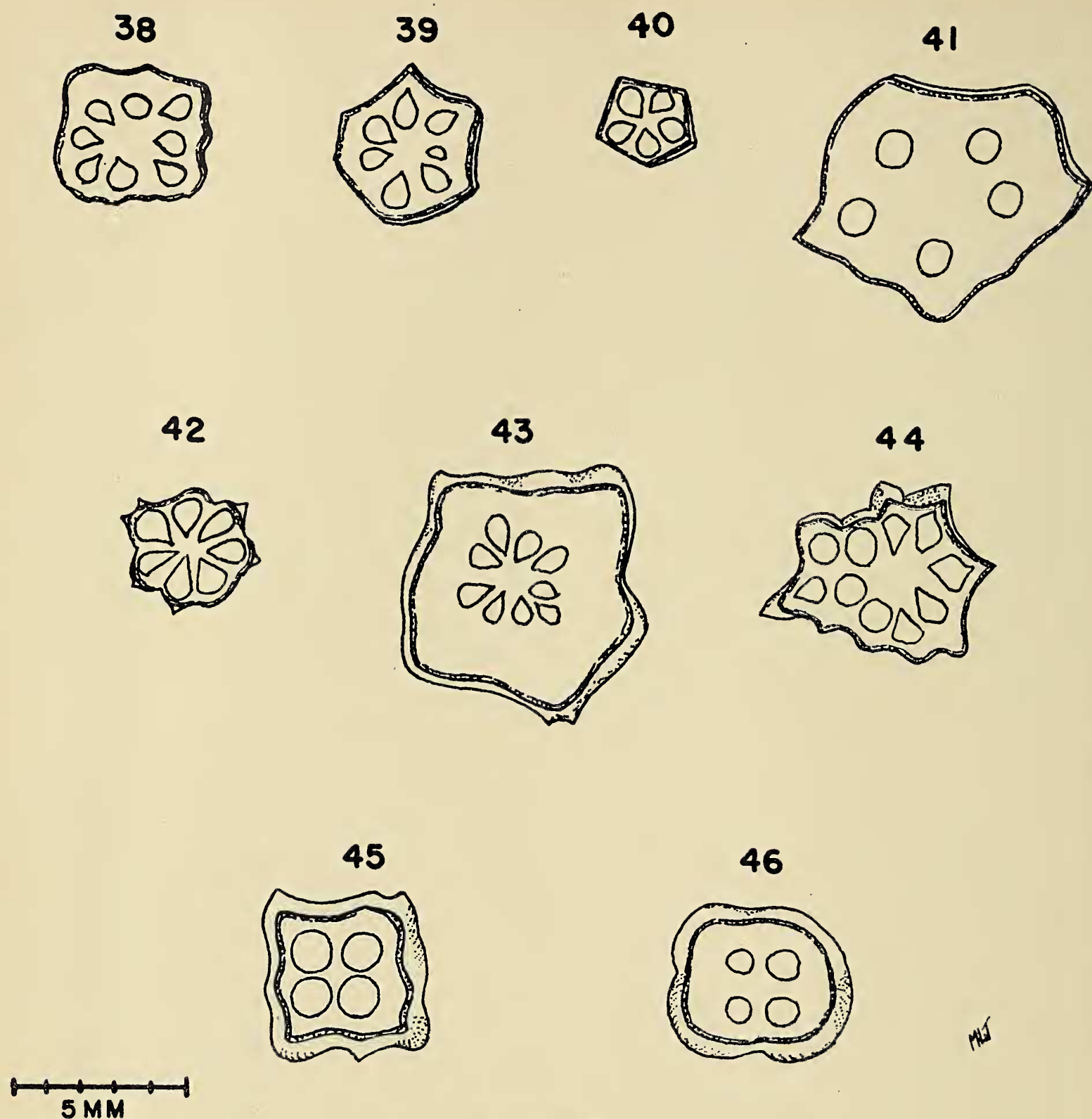


PLATE III

Reproductive structures of the Polynesian species of *Myoporum*.

EXPLANATION OF PLATE

Endocarps in cross section.

M. sandwicense var. *sandwicense*: (38) from V. O. Fosberg 93, Oahu; (39) from Webster 1081, Oahu; (40) from Degener 9737, Molokai. *M. sandwicense* var. *Fauriei*: (41) from Webster & Wilbur 1704, Hawaii. *M. sandwicense* var. *stellatum*: (42) from Degener 9727, Oahu. *M. sandwicense* var. *lanaiense*: (43) from Fosberg 12525, Lanai. *M. sandwicense* ssp. *St.-Johnii*: (44) from Webster & Wilbur 1835, Hawaii. *M. Stokesii*: (45) from St. John & Fosberg 15956, Raivavae. *M. rapense* var. *rapense*: (46) from Fosberg 11525, Rapa.

Puuwaawaa, 4 miles southwest of Puu Anahulu, alt. 2,000 ft., Webster & Wilbur 1874, 1883, 1895 (BISH, T); Puuwaawaa, 3 miles west of Puuwaawaa Hill, alt. 3,000 ft., Webster & Wilbur 1852, 1857 (BISH, T); Kaupu-

lehu, 2-3 miles east of Huehue, alt. 2,000 ft., Webster & Wilbur 1835 (BISH, T); Keahuolu, alt. 400 ft., on aa in dry scrub, St. John & Lane 23978 (BISH); Kapua ?, near the sea, Bryan (BISH); Kapua, on kipuka south of Hana-

keaumoe triangulation point, near sea level, *Bryan* 761 (BISH); Manuka Mauka, alt. 750–1,750 ft., *St. John et al.* 11326 (BISH); Kau, halfway between Kaalualu and Waiohinu, *Degener* 9734 (DEG, NY); old aa flow, Hilea, *Russ* (BISH); Kau District, Ninole, Wailua Ninole, basalt flow near shore, alt. 15 ft., *St. John, Hatheway, & Morton* 23950 (BISH); Punaluu, *Degener & Wiebke* 2207 (DEG, NY); on aa flow, Punaluu, alt. 500 ft., *Neal* (BISH); Hawaii National Park, Bird Park, *Degener* 9725 (DEG); Naaulu Forest, Kealakomo, alt. 1,700 ft., *Fagerlund & Mitchell* 800 (BISH).

St. John et al. 23950 has the hirsutulous style typical for the subspecies but is remarkable in having the stamen number highly variable and reduced to 2–3 in the majority of flowers. The locality of *Degener* 9725 should be regarded with suspicion because Bird Park has been visited many times by botanists, and only var. *Fauriei* has been collected there.

Form 2. Style very sparsely hirsutulous or glabrous; flower parts mostly 5–6; cells of endocarp 5–7.

Seventeen miles from Kohala toward Waimea, *Degener & Wiebke* 2208 (DEG, NY); Puu Keekee, *Degener, Greenwell, & Murashige* 20020 (DEG); 20 miles from Waimea toward Kona, *Degener & Wiebke* 2211 (DEG, NY); Puuwaawaa, *Forbes* 49.H (BISH); Kau Desert 25 miles west of Kilauea, *Degener & Wiebke* 2209 (G-DEL, NY); Kau District, Punaluu, *St. John et al.* 11316 (BISH); same locality, *St. John, Cowan, & Rogers* 22426 (BISH).

Degener, Murashige, & Greenwell 20019 (DEG), collected near Na Puukulua, is sterile and has serrate-pubescent “juvenile” leaves, but since it was found near number 20020 it probably belongs here.

9. *Myoporum sandwicense* ssp. *Wilderi* (Skottsberg) Webster, comb. nov.

Pls. I, 9; II, 23

Myoporum Wilderi Skottsberg, *Acta Horti Gotob.* 8: 165–166. 1933.

Shrubs or small trees. Leaves spatulate-elliptic or obovate-elliptic, acute or apiculate, glabrous, entire, 5–10.5 cm. long, 1.8–3.3 cm. wide. Flowers 3–4 per axil; pedicels 0.8–1 cm. long, flattened. Calyx 5-lobed, glandular-dotted, glabrous, the lobes mostly 1.5–2 mm. long. Corolla white, 7.5–9 mm. long, glandular-spotted, pubescent within, 5-lobed. Stamens 4 (sometimes with traces of a fifth according to Skottsberg). Ovary globose-pyriform, about 3 mm. long; style 3–4.5 mm. long, curved at the base, glabrous. Drupe color unknown (probably purplish or reddish); endocarp top-shaped, about 5–6 mm. long, 4–6-celled.

TYPE: Rarotonga, *Wilder* 781, in the Bishop Museum Herbarium.

This subspecies is cultivated by the natives of Rarotonga, in the Cook Islands of southern Polynesia, and has been found in the wild state only on the nearby island of Mangaia. It is fairly well distinguished from the other two subspecies by its leaf shape and by its flowers with only 4 stamens. However, most of the characters given by Skottsberg (1933: 155) to separate *M. Wilderi* from *M. sandwicense* are not applicable when a large amount of material of the latter species is examined. Hairy corolla lobes occur in most of the Hawaiian varieties, and the density of the pubescence may be as great as in the Rarotongan plant. The constant absence of the fifth stamen in the Cook Island population seems like a good distinction, but the form of var. *sandwicense* from the Waianae Range of Oahu usually lacks the fifth stamen, and similarly reduced flowers are not uncommon in var. *stellatum* and var. *Fauriei*. The length of the style does not distinguish Skottsberg's species because the style in var. *Fauriei* reaches 5 mm. and more in length. There remains the leaf shape to fall back upon, and although this is rather distinctive in ssp. *Wilderi*—the rounded apex of the elliptic leaf being rather abruptly contracted into an apiculate tip—it is variable even on the type specimen and does not seem to be a character of specific value.

Perhaps the best distinguishing character for ssp. *Wilderi* is that its flowers have an odor so noticeable that the plant is cultivated for perfume. In this respect the subspecies resembles the strongly scented Austral Island plants and contrasts with the relatively odorless Hawaiian plants. The basal curvature of the style is another link between the Cook Island and Austral Island plants; but this character is probably dependent on the length of the style and is of no great intrinsic significance.

Specimens examined

COOK ISLANDS:

Rarotonga, *Wilder* 781 (BISH, NY); Mangaia, Nov. 1928, *Graham* (BISH).

10. *Myoporum Stokesii* F. Brown, Bishop Mus. Bul. 130: 277-278, fig. 41. 1935.

Pls. I, 12; II, 24, 36; III, 45

Shrubs or trees, 1-5 m. high. Leaves elliptic-lanceolate, entire, glabrous, 3.5-9 cm. long, 0.5-1.7 cm. broad, acute, apiculate, or attenuate-acuminate, alate-petiolate. Flowers 1-3 (rarely 4) per axil, sometimes accompanied by 1 or more small abortive flowers; pedicels 0.7-1.4 cm. long. Calyx 5-lobed, glandular-dotted; calyx lobes 2-4 mm. long, entire-margined. Corolla pure white or pink-spotted in the throat, rather heavily fragrant, 9-12 mm. long, pubescent within. Stamens 4. Ovary 2.5-3.5 mm. long; style hirsutulous (rarely almost or quite glabrous), curved at the base, 4-6 mm. long when mature. Drupe translucent pink to red; endocarp turbinate, ridged, 4-6 (mostly 5) mm. long, 3-6-celled but mostly 4-celled.

TYPE: Raivavae, Matotea, alt. 78 m., April 28, 1922, *Stokes* 90, in the Bishop Museum Herbarium.

This species, known from a single island, is closely related to *M. rapense*. Its differences are not very profound but appear to be constant; for instance, no leaves of *M. Stokesii* have been found to show the serrations of *M. rapense*. *M. Stokesii* is evidently more distant

from the probable ancestor, *M. laetum*, and it seems likely that the ancestral form which populated the Austral Islands and Rapa was very close to *M. rapense* var. *rapense*.

This species is much more variable than *M. rapense*, and some of its forms diverge widely from the norm. *Fosberg* 11737 is remarkable for the petalloid appendages which are present on the stamens, but as no other specimen from the island shows this, the plant had better be regarded as a minor variant.

The inconstancy of style pubescence in *M. Stokesii* raises difficulties in separating it from *M. sandwicense*; the forms of *M. Stokesii* with glabrous styles can be positively distinguished from ssp. *Wilderi* only by their narrower leaf shape. The approach of these forms to ssp. *Wilderi* illustrates the difficulty of defining specific lines in the insular myoporums. Even though the distinctions between the Hawaiian and Austral Island species may thus break down, however, the species are in the main distinct, and it would be unwise to combine them before all the insular myoporums have been carefully studied.

Specimens examined

RAIVAVAE:

Form 1. Style copiously hirsutulous.

Near mountain top, alt. 1,000 ft., *Chapin* 871 (NY); Pic Rouge, northwest side, alt. 120 m., *St. John & Fosberg* 15947 (BISH); same locality, alt. 150 m., *St. John & Fosberg* 15956, 15964 (BISH); Maunani, ridge, alt. 900 ft., *Stokes* 11 (BISH); Matotea, alt. 78 m., *Stokes* 90 (BISH, type— as to sheet from Raivavae); "Raivavae," *Whitney expedition* 237 (NY).

Form 2. Style hirsutulous; stamens with petalloid appendages.

Vaiuru, N. E. slope, alt. 30 m., *Fosberg* 11737 (BISH).

Form 3. Style sparsely hirsutulous to glabrous.

South side of Mt. Turivao, rock ledge, alt. 240 m., *Fosberg* 11784 (BISH); south side of Mt. Araua, alt. 300 m., *St. John* 16201 (BISH);

Pic Rouge, northwest side, alt. 140 m., *St. John & Fosberg 15957* (BISH); Mt. Taraia, south side, alt. 250 m., *St. John & Kondo 15996* (BISH).

11. *Myoporum rapense* F. Brown, Bishop Mus. Bul. 130: 278–279, fig. 42. 1935.

Shrubs or trees, 1–10 m. high. Leaves lanceolate or somewhat obovate, sharply serrate, glabrous, 4–11.5 cm. long, 0.7–2 cm. broad, acute to acuminate, alate-petiolate. Flowers 1–4 (rarely 5) per axil, often 1 or more abortive; pedicels 0.5–1.5 cm. long. Calyx lobes 5, glandular-dotted, lanceolate and acuminate, 2–3.5 mm. long; margins entire, minutely serrulate, or prominently ciliate. Corolla 5-lobed (rarely 6-lobed), white, pink, or purple-spotted in the throat, with a heavy sweet or sometimes fetid odor, 8–12 mm. long, pubescent within. Stamens 4, all well developed or one a rudiment. Ovary 2.5–3.5 mm. long; style hirsutulous, curved at the base, 4–6 mm. long. Drupe brick- or purplish-red; endocarp turbinate or oblong-ellipsoid, not or scarcely ridged, 5–8 mm. long, 3.5–5.5 mm. wide, 3–6-celled (often one or more cells empty).

This species occurs on Tubuai, Raivavae, and Rapa and is more constant morphologically than is its probable derivative *M. Stokesii*. It is separated from this latter species by characters which are very stable for the genus *Myoporum*, and only one specimen is in any way intermediate. The form of *M. rapense* on Raivavae has typical leaves and fruit but flowers more nearly the size of *M. Stokesii*. This form does not seriously break down the boundaries between the two species, however, and it seems best to maintain them as distinct.

While *M. rapense* is clearly separable from *M. Stokesii*, it is not nearly so easily distinguished from the New Zealand *M. laetum*. For the present, however, its more inconspicuously punctate leaves (fully discussed under Morphological Criteria earlier in this paper) may serve to separate it.

12. *Myoporum rapense* var. *rapense*

Pls. I, 15; II, 25, 37; III, 46

Myoporum rapense F. Brown, Bishop Mus. Bul. 130: 278–279, fig. 42. 1935.

Leaves lanceolate or obovate-lanceolate, 4–10 cm. long, 0.7–2 cm. broad. Calyx lobes lanceolate, acuminate, 2–3 mm. long; margins entire or minutely serrulate. Corolla 8–9 (rarely 11–12) mm. long. Ovary 2.5–3 mm. long; style 4–5 (rarely 6) mm. long. Endocarp 5–8 mm. long, 3.5–5.5 mm. broad, 3–6-celled.

TYPE: Rapa, alt. 170 m., Sept. 13, 1921, *Stokes 161*, in the Bishop Museum Herbarium. Brown (1935:279) cited two collections from Rapa as types. I have chosen the first one as the lectotype, since the number of the other (*Stokes 90*) is the same as the type of *M. Stokesii*.

Specimens examined

RAIVAVAE:

This form has a corolla about 12 mm. long, style 6 mm. long.

Vaiuru, 1 km. east, top of beach, alt. 0.5 m., *Fosberg 11723* (BISH).

RAPA:

This form has a corolla 8–9 mm. long, style 4–5 mm. long.

Anarua, alt. 50 ft., *Stokes 161* (BISH, type); Anarua Valley, southeast ridge of Mt. Perahu, alt. 300 m., *Fosberg 11521* (BISH); Matauri Point, near lower edge of forest, alt. 3 m., *Fosberg 11525* (BISH); Anarua Bay, top of beach, alt. 1 m., *St. John 15707* (BISH); Area, alt. 145 m., *St. John & Fosberg 15280* (BISH); Toutore, west of Mt. Vaitau, alt. 240 m., *St. John & Maireau 15409* (BISH); northeast ridge of Mangaoa Peak, alt. 320 m., *St. John & Maireau 15381* (BISH); north slope of Mt. Lekie, mixed woods, alt. 250 m., *St. John & Maireau 15624* (BISH); Karapo Rahi I. [islet off Rapa], alt. 75 m., *St. John & Maireau 15600* (BISH); Taunoa Ridge, alt. 400 ft., *Stokes 90* (as to sheet from Rapa) (BISH); Hiri, north ridge from Lekie, alt. 500 ft.,

Stokes 217 (BISH, NY); Kulukulu, Hiri, ridge, alt. 170 ft., *Stokes 304* (BISH).

13. *Myoporum rapense* var. *Skottsbergii*
Webster, var. nov.

Pls. I, 14; II, 26

Lobae calicis ciliatae.

Leaves elliptic-lanceolate, 5.5–8 cm. long, 1.2–1.7 cm. broad. Calyx lobes ovate, acuminate-tipped, sparsely long-ciliate on the margins, about 2 mm. long. Corolla 10.5–11 mm. long. Ovary 2.5 mm. long; style 4–4.5 mm. long. Color of flowers and fruits unknown; endocarp 5.5–6 mm. long, with 2 fertile and 2 sterile cells in the one fruit cut open.

TYPE: "Toubouia" [=Tubuai], *Cuming 1430*, in the Kew Herbarium.

This variety is known only from the type collection made by Cuming in 1828. One might explain its not having been collected there again by assuming that the locality given on the label is incorrect, but St. John (1940: 88) has studied Cuming's voyages and cites his collection numbers 1423–1433 as being made on Tubuai. A more likely explanation is that the variety is extinct, inasmuch as St. John and Fosberg did not find it in 1934 after a careful search of the few remaining acres of native forest (personal communication from Dr. St. John).

This variety is named in honor of Dr. Carl Skottsberg, who for many years has been a student of *Myoporum* (and numerous other genera) in the Pacific islands.

DOUBTFUL AND EXCLUDED SPECIES

Myoporum ? euphrasioides Hook. & Arn., Bot. Beechey Voy. 67, 1832.

This plant, described from Whitsunday Island (= Pinaki I., Tuamotus), is now known as *Nesogenes euphrasioides* (Hook. & Arn.) A. DC. Because Hooker and Arnott included the Tuamotus in the Society Islands, a number of writers listed *Myoporum euphrasioides* from the latter group.

Myoporum rimatarense F. Brown, Bishop Mus. Bul. 130: 280, fig. 43. 1935.

This species from Rimatara, Austral Islands, is known from such fragmentary material (the flowers being unknown) that its exact disposition is impossible. Judging from the leaf shape it might be a form of *M. sandwicense* ssp. *Wilderi*, but this is only a guess. St. John tells me that the vegetation on Rimatara is badly despoiled and that the *Myoporum* there may well be extinct.

Myoporum tenuifolium Forst f., Prodr. 44. 1786.

Nadeaud (1897: 113) credits this species to Tahiti (as a cultivated plant) and to Raivavae. The Raivavae plant is probably *M. Stokesii*. The cultivated Tahitian plant may also be *M. Stokesii*, but I have seen no specimens. *M. tenuifolium* is one of the most widespread species of the genus, occurring from New Caledonia into Micronesia, but it has not been collected in Polynesia proper.

REFERENCES

- BENNETT, GEORGE. 1832. An account of the sandal wood tree (*Santalum*), with observations on some of the botanical productions of the Sandwich Islands. *Mag. Nat. Hist.* 5: 255–261.
- BENTHAM, GEORGE. 1870. *Flora Australiensis*. Vol. 5. viii+599 pp. L. Reeve & Co., London.
- BRIGHAM, WILLIAM T. 1908. *The ancient Hawaiian house*. Bernice P. Bishop Mus., Mem. 2(3): iv+185–378, pls. 18–40, 178 figs.
- BROWN, FOREST B. H. 1935. *Flora of South-eastern Polynesia—III. Dicotyledons*. Bernice P. Bishop Mus., Bul. 130: ii+386 pp., 9 pls., 70 figs.
- CHEESEMAN, T. F. 1903. The flora of Rarotonga, the chief island of the Cook Group. *Linn. Soc. Lond., Trans. Bot.* II, 6(6): 261–313, map, pls. 31–35.

- DE CANDOLLE, ALPHONSE. 1847. *Prodromus systematis naturalis regni vegetabilis*. Vol. 11: 1-736. Victoris Masson, Paris.
- DEGENER, OTTO. 1930. *Illustrated guide to the more common or noteworthy ferns and flowering plants of Hawaii National Park with descriptions of ancient Hawaiian customs and an introduction to the geologic history of the islands*. xv+312 pp., frontisp., 95 pls., 45 figs. Honolulu Star-Bulletin, Ltd., Honolulu.
- EGLER, FRANK E. 1947. Arid southeast Oahu vegetation, Hawaii. *Ecol. Monog.* 17: 383-435, 41 figs.
- FORBES, CHARLES N. 1913. Notes on the flora of Kahoolawe and Molokini. *Bernice P. Bishop Mus., Occas. Papers* 5(3): 85-97, 7 figs.
- FORSTER, G. (=J. G. A.). 1786. *Florulae insularum australium prodromus*. 103 pp. Dietrich, Gottingen.
- FOSBERG, F. RAYMOND. 1943. *The Polynesian species of Hedyotis (Rubiaceae)*. *Bernice P. Bishop Mus., Bul.* 174: 1-102, 4 pls., 9 figs.
- GRAY, ASA. 1866. Characters of some new or obscure species of plants, of monopetalous orders, in the collection of the United States South Pacific Exploring Expedition under Captain Charles Wilkes, U.S.N. *Amer. Acad. Arts and Sci., Proc.* 6: 37-55.
- HOOKE, WILLIAM JACKSON, and G. A. ARNOTT. 1830-1841. *The botany of Captain Beechey's voyage comprising an account of the plants collected by Messrs. Lay and Collie, and other officers of the expedition during the voyage to the Pacific and Bering's Straits, performed in His Majesty's ship, Blossom, under the command of Captain F. W. Beechey . . . in the years 1825, 26, 27, and 28*. ii+485 pp., 99 pls. Treuttel, Wurz, Treuttel Jr., & Richter, London.
- KRAENZLIN, F. 1929. Beitrage zur Kenntnis der familie der Myoporinae R. Br. *Fedde Repert. Sp. Nov. Beih.* 54: 1-129.
- LÉVÉILLE, H. 1912. Decades plantarum novarum XC-XCII. *Fedde Repert. Sp. Nov.* 11: 63-67.
- NADEAUD, J. 1897. Note sur quelques plantes rares ou peu connues de Tahiti. *Jour. Bot. Morot* 11(7): 113-120.
- ROCK, JOSEPH F. 1913. *The indigenous trees of the Hawaiian Islands*. iv+518 pp., 215 pls. Honolulu.
- ST. JOHN, HAROLD. 1940. Itinerary of Hugh Cuming in Polynesia. *Bernice P. Bishop Mus., Occas. Papers* 26(4): 81-90, portr.
- SKOTTSBERG, CARL. 1933. *Myoporum* in Rarotonga. *Acta Horti Gotob.* 8: 147-167, 48 figs.
- SOLEREDER, HANS. 1899. *Systematische Anatomie der Dicotyledonen*. xii+984 pp., 189 figs. Ferdinand Enke, Stuttgart.
- WETTSTEIN, R. VON. 1895. Myoporaceae. In: Engler & Prantl, *Naturl. Pflanzenfam.* IV: 3b., 354-360, figs. 142-144. Wilhelm Engelmann, Leipzig.
- WILDER, GERRIT PARMILE. 1931. *Flora of of Rarotonga*. *Bernice P. Bishop Mus., Bul.* 86: 1-113, 8 pls., 3 figs.
- ZIMMERMAN, ELWOOD C. 1948. *Insects of Hawaii*. Vol. I: Introduction. xx+206 pp., 52 figs. University of Hawaii Press, Honolulu.